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Secondary phytocenosis of Seaside Ajara

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Specialty: **Plant Biodiversity**

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General Overview of the Paper

Actuality of the topic: disruption impact of human on ecosystems promotes its response – through secondary autogenic succession. Those successions vary, as it is in case of variations for anthropogenic influence on ecosystems. This is when plant species (adventive) with foreign origin invade and inhabit the plant community, which has now taken quite a large scale. During the recent decades, there have been real facts demonstrating the process acceleration. This process was caused by a constant destruction of natural landscape and import (introduction) of alien species to the region as well, through exiting a lag phase of before imported species and rapid expansion of the secondary areas and adaptation to the new type of residence.

This is actual topic for the South Colchis (Ajara) vegetation. Influence of the anthropogenic factors, irrational use of natural vegetation and careless and abandoned agricultural lands have led to distinctive transformation of flora and vegetation in the phyto-landscapes of the seaside Ajara reflected in a high potential for invasion of foreign origin (adventive) species in the formed secondary phytocenosis. Vegetation changes caused by invasion of alien species is syngeneic succession, this is a result of anthropogenic-invasion processes formed in florogenesis, which have oppressed indigenous species, in particular, those whose 'shelter'– refugium was ripped.

There are a number of researches made on the species composition of Ajarian adventive flora. However, current condition of the secondary communities (phytocenosis, plant groups) created through the alien species have not been studied yet.

Thus, studying of the transformed secondary vegetation observed in the seaside Ajara lowland and foothills (hillocks), which is considered as the key place for vegetation invasion in Colchis, is of high relevance. It is scientifically interesting to see what is a level of exiting serial phytocenoses (vegetation groups) in terms of restorative succession (consistent) change and what are their development perspectives.

Research aim and goals: the main aim of the research is to study the secondary phytocenoses of in seaside Ajara, in particular, Kobuleti, Chakvi and Kakhaberi lowlands and surrounding hillocks. The following goals are set for execution:

- Analysing literature;
- Studying invasion routes of alien species in the research territory and description of chronology and dynamics of species spread;
- Selection, taking GPS coordinates and mapping of the secondary phytocenoses (vegetation groups) in the seaside Ajara;
- Studying species composition, revealing dominant species, identifying cenosis of the secondary phytocenosis (vegetation groups);
- Researching formation of the secondary phytocenoses structure, identifying its regularities and characteristics;
- Development of the common database of the recorded plants;
- Taxonomic and geographical analysis of the recorded plants;
- Photographing the objects.

Research object and methodology: the research was carried during 2016-2019 in the seaside zone of Kobuleti, Chakvi and Kakhaberi, from Sarpi to Choloki. At first, we carried recognition works from the seashore lowland to hillocks, which considers background observation of the research territory and identifying the research objects. Recordings on alien species were carried on the following habitats: natural, secondary and artificial cenosis (agro-cenosis); habitats in railway surrounding area; habitats in

highway surrounding area; parks, nurseries, abandoned green places; abandoned, degraded tea plantations; landfills, ruderal places; sea shore calloused sandy soils.

The geo-botanical descriptions were carried in the selected secondary phytocenoses (vegetation groups). In total, 11 objects (releves) were selected. On 10 releves geobotanical description was made through square methodology, and on one releve (Batumi landfill) floral examination was made, because developing cenosis on the research object was non-sustainable.

Alien and local plants on the mentioned locations were the research material.

The main research method used was a traditional route, expedition method to collect materials. Laboratory analysis, identification and preparation of herbariums were carried in the Department of Biodiversity, Monitoring and Conservation of the Phytopathology and Biodiversity Institution in Kobuleti.

Various guides and scientific literature were used for identification of the species: Identification Guide of Ajarian Flora by A. Dimitrieva (Dmitrieva 1959, 1967, 1990), identification guides of Georgia (1964, 1971–2015; Fischer at all.2018); Georgian Flora (1969); 'Summary-Nomenclature List of Georgia Flora' (Gagnidze, 2005); Adventive Flora of Ajara (Davitadze, 2001), internet resources and database of world invasive species (www.biodiversity-georgia.net; www.gisin.org). The nomenclature is presented according to the world flora database - The Plant List (www.theplantlist.org), as for Georgian names of the plants – according to the botanical dictionaries of A. Makashvili (1991) and A. Gagnidze-Dvali (2014). Foreign publications by H. Martin Jahns (Jahns, 1996) and J. Merryweather (Merryweather) were used for identification of mosses and ferns.

GPS coordinates were taken and mapped at the selected objects;

Plants description in the secondary phytocenosis was carried by using mixed Releve and square methods (Braun-Blanquet System, 1955; Mueller-Dombois, 1925; Müller &Schmetterer, 1974; Releve…, 2013).

On releve, the plants descriptions are made with fixed intervals. Square sizes on the length of releve are different according to the plant cover. In case of tree plants, it varies between 15-40 m^2, while in mosses – 0.25-0.5 m^2.

Abundance/cover of the species in the research plant groups was studied according to the Braun Blanquet Scale.

5=75%-100%. Range of cover 5 complies with a specific specie, cover of which in the releve species phytocenological group varies from 75% to 100% of total area.

4=50-75%. Range of cover 4 complies with specific species, cover of which in the releve species phytocenological group varies from 50% to 75% of total area.

3=25%-50%. Range of cover 3 complies with specific species, cover of which in the releve species phytocenological group varies from 25% to 50% of total area.

2=5%-25%. Range of cover 2 complies with specific species, cover of which in the releve species phytocenological group varies from 5% to 25% of total area.

1=less than 5%. Abundance (number) coefficient 1 complies with specific species in the phytocenological group, where there are multiple individuals of the species, and those individuals together cover from 1 to 5% of the total area.

+=less than 5%. Abundance (number) coefficient + complies with the specific species in the phytocenological group, where there are multiple individuals of the species, and those individuals together cover less than 5% of the total area.

r=less than 5%. Abundance (number) coefficient r complies with the specific species in the phytocenological group, where there are multiple individuals of the species, and those individuals together cover less than 5% of the total area.

Developed and sustainably developing group of plant groups were not identified in the Batumi landfill territory, thus the florist analysis was made. On the rest 10 releves up to 500 squares were made to carry plant recordings.

Scientific novelty and practical value: cenotic characteristics of the secondary vegetation in the seaside Ajara, in particular, hills and hillocks of Kobuleti, Chakvi and Kakhaberi lowland have been studied and the secondary phytocenoses were distinguished for the first time. A current condition of naturalised ligneous plants, reproduction, distribution and engagement characteristics in cenosis were studied. A potential of invasive species was analyzed, common general list of the plants was developed. Taxonomic and geographical analysis of the recorded plants was carried, distribution characteristics on the research objects were studied. Flora in the Batumi landfill was researched and florist analysis was made accordingly. Three new alien species for Ajara flora were recorded.

The work paper materials may be useful for developing the environmental activities. Materials collected during research will be a basis for a monitoring anthropogenic change of vegetation in the seaside Ajara and developing online database and flora atlas of the alien plants on the given territory.

Approbation of research outcomes: The research materials are described in the annual report of the Phytopathology and Biodiversity Institute and seminar and colloquium works presented for the Biology Department of the Natural Science and Health Faculty in 2016-2019 at Batumi Shota Rustaveli State University. The work successfully got approbation at the faculty council, in 2020.

The results of the paper are published in 6 scientific articles.

Dissertation volume and structure. Text of dissertation covers 151 electonically printed pages and includes introduction, literature review, experimental part, conclusions, bibliography (117 units) and appendix. There are 13 tables, 6 figures (diagram) and 30 pictures in the text.

Literature Review

The literature review materials are presented in the first part of dissertation. The first chapter presents a general overview of physical-geographical conditions in the seaside Ajara. The second chapter discusses research history of alien origin (advent) plants and general overview of botanical researches. It gives detailed classification and general topics of history of alien origin plants. Spreading dynamics in the seaside Ajara has been studied. Comprehensive literature material and analysis have been made on general topics of acclimatisation-naturalisation and invasion.

Experimental Part

Results of experimental research are presented in the third and the following chapters.

3. Alien origin naturalised ligneous plants in the seaside Ajara

The Batumi Botanical Garden, parks, nurseries, plant species brought in by the private summer visitors and plant lovers for different purposes played a significant role in spread of alien vegetation in the seaside Ajara.

Our observations and recordings were carried for studying current conditions of the woody plants and plants with ligneous stems (bamboo). The main focus was made on reproduction and distribution characteristics. According to the research, the part of the alien plants grows well, blossoms, bears fruits, produces self-crops and root succkers.

Research and recording in the research territory in total revealed 68 species of 48 genera of 31 families of ligneous plants and plants with woody stems: *Acacia dealbata* Link., *Acacia melanoxylon* R.Br., *Acer negundo* L., *Ailanthus altissima* (Mill.) Swingle., *Albizia julibrissin* Durazz., Akebia *quinata* (Houtt.) Decne., *Aleurites cordata* R. Br. ex Steud., *Aleurites fordii* Hemsl. /*Vernicia fordi* (Hemsl.) Airy Shaw., *Amorpha fruticosa* L., *Berberis levis* Franch., *Buddleja davidii* Franch., *Juglans cordiformis* Wangenth. /*Carya cordiformis* (Wangenth) K.Koch., *Catalpa speciosa* (Warder ex Barney) Warder ex Engelm., *Cedrus deodara* (Roxb. ex D.Don) G.Don. *Cinnamomum glanduliferum* (Wall.) Meisn., *Cinnamomum japonicum* Siebold./ *Cinnamomum japonicum var. chekiangense* (Nakai) M.B. Deng & G. Yao., *Cryptomeria japonica* (Thunb. ex L.f.) D.Don., Cupressus *lusitanica* Mill., *Cudrania tricuspidata* (Carrière) Bureau/*Maclura tricuspidata* Carrière., *Daphniphyllum macropodum* Miq., *Deutzia scabra* Thunb., *Elaeagnus umbellat*a Thunb., *Elaeagnus pungens* Thunb., *Eriobotrya japonica* (Thunb.) Lindl., Euiccalyptus cinerea F.Muell. ex Benth., *Euiccalyptus globulus* Labill., *Euiccalyptus viminalis* Labill., *Fatsia japonic*a (Thunb.) Decne. & Planch., *Gleditschia triacanthos* L., *Hovenia dulcis* Thunb., *Hydrangea macrophylla* (Thunb.) Ser., *Juglans ailanthifolia* Carrière., Juglans ailanthifolia v. cordiformis/ J. cordiformis Wangenh/*Carya cordiformis* (Wangenh.) K.Koch., *Laurus nobilis* L., *Lespedeza bicolor* Turcz., *Ligustrum japonicum* Thunb., *Ligustrum lucidum* W.T.Aiton., *Ligustrum sinense* Lour., *Liquidambar styraciflua* L., *Liriodendron chinense* (Hemsl.) Sarg., *Liriodendron tulipifera* L., *Lonicera japonica* Thunb., *Mallotus japonicus* (L.f.) Müll.Arg., *Paulownia tomentosa* StDicd., *Phyllostachys edulis* (Carrière) J.Houz., *Phyllostachys bambusoides* Siebold & Zucc., *Pseudosasa japonica* (StDicd.) Makino., *Pseudosasa hindsii* (Munro) C.D.Chu & C.S.Chao., Pseudosasa humilis (Mitford) T.Q.Nguyen., *Pinus pinaster* Aiton., *Pinus taeda* L., *Pueraria montana var. lobata* (Willd.) Sanjappa & Pradeep., *Quercus acuta* Thunb., *Quercus acutissima* Carruth., *Quercus glauca* Thunb., *Quercus myrsinifolia* Blume., *Quercus palustris* Münchh., *Quercus falcata* Michx., *Rhus javanica* L/ *Brucea javanica* (L.) Merr., *Robinia pseudoacacia* L., *Rosa multiflora* Thunb., *Spiraea cantoniensis* Lour., *Spiraea japonica* L.f., *Taxodium distichum* (L.) Rich., that have adopted to the soil climate conditions, are characterised with reproduction (vegetative and generational).

Thus, those species are reproduced, spread and settled in the transformative phytocenosis. New cenotic links are established through local and alien species, and in some cases, cenoses are presented only with alien origin ligneous plants, as they are characterised with rapid growth and high productivity.

As revealed by the data, the following families are distinguished with diversity of species: legume (*Leguminosae*) – 9 species, beech (*Fagaceae*) - 6 species, grasses (*Poaceae*) - presented by 5 species, rose and olives families *(Rosaceae & Oleaceae)* with 4 species each, and myrtle, walnut, pine and laurel families (*Myrtaceae, Juglandaceae, Pinaceae, & Lauraceae*) are presented with 3 species each. And the rest with 2 or one species.

Oak (*Quercus* L.) is a rich family presented by 6 species, eucalyptus, privet and pseudosasa *(Euiccalyptus* L'Hér*., Ligustrum* L*, Pseudosasa* Makino ex Nakai) with three species each, acacia, aleurites, cinnamomum, oleaster, walnut, tulip, pine, bamboo and meadowsweets (*Acacia* Martius*, Aleurites J*.R.Forst. & G.Forst*, Cinamomum* Schaeff*, Eleagnus* L*, Juglans* L*, Liriodendron* L*., Phyllostachys* Siebold & Zucc*., Pinus* L*., Spiraea* L.) – with 2 species each, while the rest genera are presented with one specie each.

According to the areal and florogenetical analysis of the researched woody vegetation, the majority of the species have the East Asian (47 species) elements and represent 68% of the naturalised woody plants. 13 species are North American, 5 species – Australian, 2 – of Mediterranean origin, 1 – Himalayan (fig. 1).

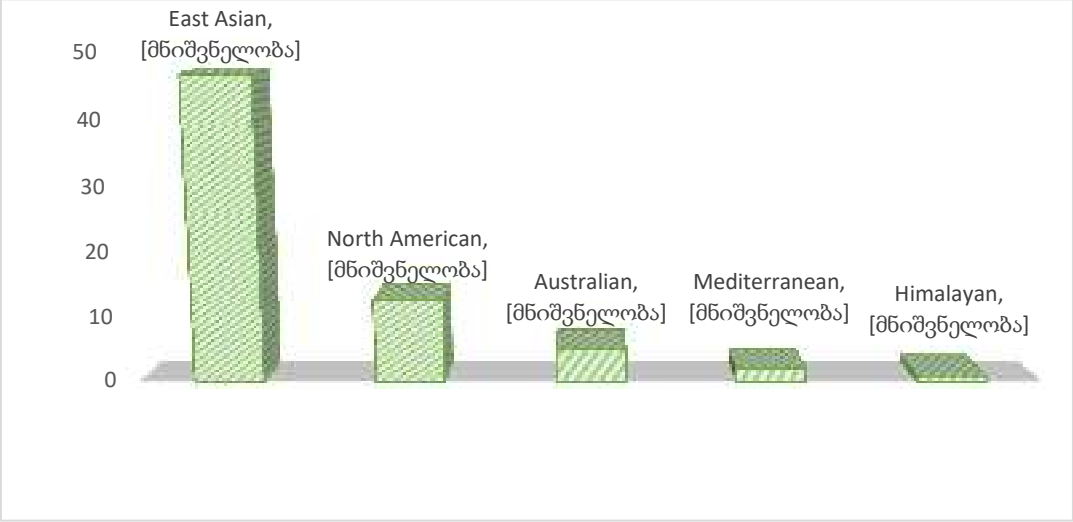

Fig.1. Spectrum of the ligneous species according to origin

Abundance of East Asian species depends on not only carrying-spreading of diaspora and ability for adaptation, but the soil-climate conditions in the Ajara seaside zone similar to East Asian. As for vegetation with American origin, species from the east coast of America (10 out 13 species are spread in the east coast of America) are the most dominant in the Ajara Black Sea zone.

In case of the Mediterranean Sea origin, the maritime pine *(Pinus pinaster*) shall be mentioned, which is characterised with high naturalisation and prevalent distribution amplitude in the seaside strip.

According to the simple classification of live forms, in case of naturalized-turned wild woody vegetation, tree plants are presented with 41 species (60.3%), bushes – 17 species (25%), liana – 4 species (5.9%), palm – 1 specie (1.4%) and perennial woody stem grass (bamboo) – 5 species (7.4%) (Fig. 2).

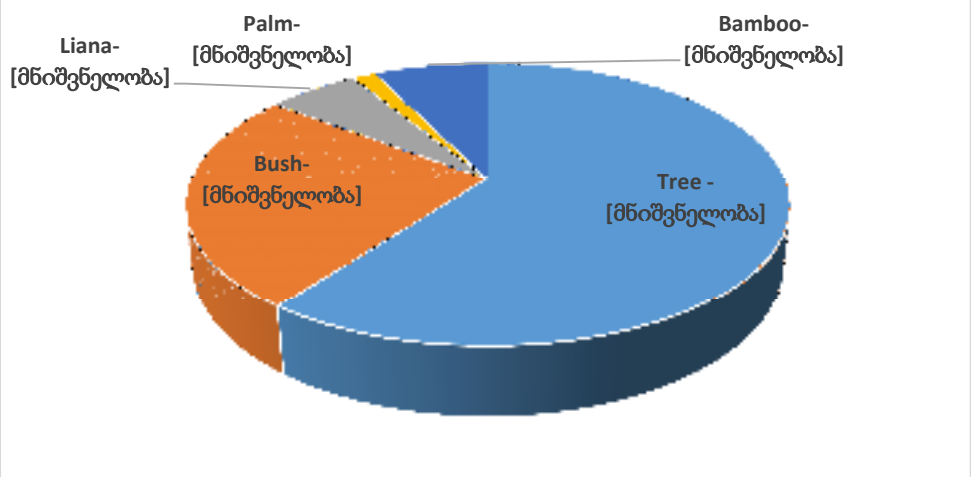

Fig. 2. Distribution of naturalized ligneous plants by live forms

94% or 64 species of the studied naturalised woody species are deciduous, and 6% or 4 species are coniferous (Fig. 3).

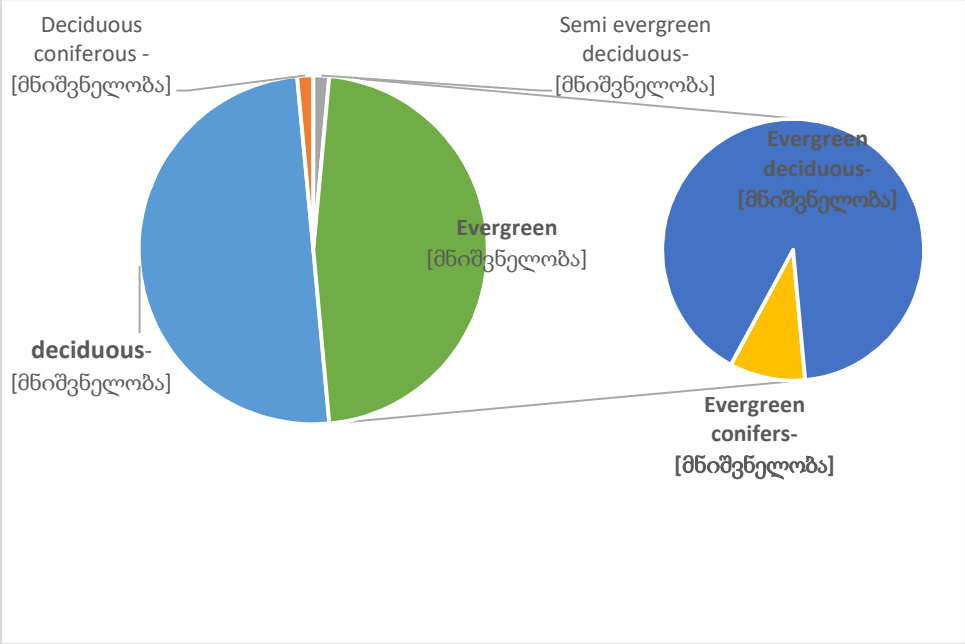

Fig. 3. Distribution of naturalized ligneous plants in biological groups

3 species (4%) are evergreen conifers, 29 species (43%) are evergreen deciduous, 34 species (50%) are deciduous, 1 specie (1.5%) is deciduous coniferous, 1 specie (1.5%) is semi evergreen.

According to the long-term introduction, climate researches and our studies carried in the Ajara seaside zone, naturalisation (in other words, species turning wild) is an adaptation, growth-development, sprouting, bearing fruit, vegetative and seed reproduction and spread of the alien origin vegetation without human involvement in the new, changed conditions.

In the researched woody species, self-crops are developed around maternal plant, under crown, in a distance with a maternal plant. They are also characterised with the different bio ecological characteristics and thus they are spread and creating cenosis differently. The following groups are outlined:

1. Species are abundantly propagated in vegetative and generational way, expelling local, as well as, alien origin plants and creating particularly clear groupings. There are 7 species of 4 genera (*Amorpha* L., *Phyllostachys* Siebold & Zucc., *Pseudosasa* Makino ex Nakai., *Pueraria* DC), of 2 families (*Leguminosae, Poaceae*) in the mentioned group: *Amorpha fruticosa* L., *Phyllostachys edulis* (Carrière) J.Houz, *Phyllostachys bambusoides Siebold & Zucc., Pseudosasa japonica (StDicd.) Makino., Pseudosasa hindsii (Munro) C.D.Chu & C.S.Chao., Pseudosasa humilis (Mitford) T.Q.Nguyen., Pueraria montana var. lobata (Willd.) Sanjappa & Pradeep,* out of which 5 species are bamboo, 1 liana and 1 bush. 6 species are eastern Asian.

Species united in the group are characterised with adaptation to the local soil climate conditions, competitiveness and aggressiveness. Bamboos are reproducec through vegetative reproduction with root sprouts creating boskets that are difficult to penetrate for other plants. *Amorpha* is reproduced through seed and vegetative reproduction, and it is widely spread in the surroundings of railway. *Pueraria* is reproduced easily with the root sprouts, stem rooting and seed. It is deciduous bindweed plant, which uses other plants as a support and limits their development and provokes grass cover.

2. Species are reproduced abundantly creating cenotic links with local and alien origin plants. It unites16 species: Acacia dealbata Link., Acacia melanoxylon R.Br., Acer negundo L., Ailanthus altissima (Mill.) Swingle., Albizia julibrissin Durazz., Aleurites cordata R. Br. ex Steud., Aleurites fordii Hemsl. /Vernicia fordii (Hemsl.) Airy Shaw., Buddleja davidii Franch., Cinnamomum glanduliferum (Wall.) Meisn., Cinnamomum camphora (L.) J.Presl., Cryptomeria japonica (Thunb. ex L.f.) D.Don., Lespedeza

bicolor Turcz., Lonicera japonica Thunb., Rhus javanica L/Brucea javanica (L.) Merr., Spiraea japonica L.f., Robinia pseudoacacia L.

The species in this group are reproduced through vegetative and generational reproduction, are distinguished with less aggressiveness compared to the previous group. The majority of the species (11 species) are East Asian. 10 species are deciduous, 6 evergreens, including, one coniferous.

3. The species are reproduced around maternal plant, sometimes quite abundantly, they create cenotic links with other species and are spread far from cultivation locations. There are 30 species in this group: *Juglans cordiformis Wangenth. /Carya cordiformis (Wangenth) K.Koch., Catalpa speciosa (Warder ex Barney) Warder ex Engelm., Cedrus deodara (Roxb. ex D.Don) G.Don., Daphniphyllum macropodum Miq., Elaeagnus umbellata Thunb., Elaeagnus pungens Thunb., Eriobotrya japonica (Thunb.) Lindl., Eucalyptus cinerea F.Muell. ex Benth., Eucalyptus globulus Labill., Eucalyptus viminalis Labill. Gleditschia triacanthos L., Hovenia dulcis Thunb., Juglans ailanthifolia Carrière., Juglans ailanthifolia v. cordiformis/ uglans cordiformis Wangenh/ Carya cordiformis (Wangenh.) K.Koch., Ligustrum japonicum Thunb., Ligustrum lucidum W.T.Aiton., Ligustrum sinense Lour., Liquidambar styraciflua L., Liriodendron chinense (Hemsl.) Sarg., Liriodendron tulipifera L., Mallotus japonicus (L.f.) Müll.Arg., Paulownia tomentosa StDicd., Pinus pinaster Aiton., Pinus taeda L., Quercus acutissima Carruth., Quercus palustris Münchh., Quercus falcata Michx., Rosa multiflora Thunb., Trachycarpus fortunei (Hook.) H.Wendl., Vitex trifolia subsp. litoralis Steenis.*

The majority of the plants in this group are reproduced through seeds. 12 species are evergreen, 18 deciduous. Species of East Asian origin are also dominant here (14 species). The second place goes to North American with 7 species, third place – Australian (3 species).

4. Species are propagated abundantly only around maternal plant, without leaving cultivation places and creating cenosis: *Akebia quinata (Houtt.) Decne., Berberis levis Franch., Cupressus lusitanica Mill., Cudrania tricuspidata/Maclura tricuspidata Carrière., Deutzia scabra Thunb., Hydrangea macrophylla (Thunb.) Ser., Laurus nobilis L., Quercus acuta Thunb., Fatsia japonica (Thunb.) Decne. & Planch., Quercus glauca Thunb., Quercus myrsinifolia Blume., Spiraea cantoniensis Lour., Taxodium distichum (L.) Rich., Thea sinensis L., Wisteria sinensis (Sims) Sweet.* Out 15 species, 12 are East Asian.

Following a purpose of the research, it was particularly important for us to study cenosis created by the alien species, to determine species composition and distribution characteristics with significant emphasis on the ligneous plants.

4. Secondary phytocenosis of lowland and hills in the seaside Ajara

Forest take up about 1/3 (32-35%) of the territory of Georgia. The most forests are natural forests, which had been undergoing phytogenic structure development for a long period of time. There are temporary (produced, secondary) forest formations within a geographical area of the natural forest formations. The transformation process of natural forest to temporary (produced) and after-forest plants was accelerated and coverage area of transformed (secondary) vegetation has been excessively expanded in the recent centuries, which was basically caused by human negative influence on the natural forest vegetation (phytocenosis) (excessive use of forest materials, uncontrolled cutting of wood, artificial fires in forest, unarranged grazing by domestic animals in the forest or formerly forested area, and other).

In recent historical past, mixed subtropical and mixed broadleaf forests were common for Colchis lowland – flatland and foothills (hills and hillocks), with a leading of chestnut (*Castanea sativa* Mill.), beech (*Fagus orientalis* Lipsky), the oak (*Quercus hartvisiana* Steve), linden (*Tilia caucasica* Rupr.), Caucasian walnut (*Pterocarya pterocarpa* (Michx.) Kunth ex Iljins), persimmon (*Diospyros lotus* L.) and other. Currently, the most of those forests in the seaside Ajara and Colchis lowland are represented as the secondary meadows, the secondary alien origin grasses, woody trees and bushes, breached alien

phytocenosis, caused by anthropogenic influence. Species characterised for the natural forests are left few only limited geographical area.

We recorded and distinguished 11 research objects in the selected secondary cenoses in the seaside Ajara lowlands and hillocks.

4.1. The secondary phytocenosis in the Kobuleti lowland and hillocks

Six vegetation groups were determined by the research carried in the Kobuleti lowland and hillocks:

1. Vegetation group created by a dominance of Japanese cedar (*Cryptomeria japonica*);
2. Vegetation group created by a dominance of eucalyptus (*Eucalyptus viminalis, E. Globulus, E. cinerea*);
3. Vegetation group created by a dominance of false camphor tree (*Cinnamomum glanduliferum*) and Japanese cedar (*Cryptomeria japonica*);
4. Vegetation group created by a dominance of Japanese timber bamboo (*Phyllostachys bambusoides*).
5. Vegetation group created by a dominance of the moso bamboo (*Phyllostachys edulis)*.
6. Vegetation group created by a dominance of bamboo-leaf oak (*Quercus myrsinifolia*), black alder (*Alnus glutinosa subsp. barbata*) and Japanese cedar (*Cryptomeria japonica)*.

4.1.1. Vegetation group with a dominance of Japanese cedar (*Cryptomeria japonica (Thunb. ex L.f.) D.Don*).

The mentioned territory is in the Kobuleti lowland, at 17-29 meters above sea level. Field recordings were carried within GPS marked coordinates between T733234/4633105; T 733472/4633242; T0733509/4633134. Exposition is flatland with poorly developed soil. In the 1920s, channels were laid out, beech (*Fagus orientalis*), hornbeam (*Carpinus caucasica*), oak (*Quercus hartvisiana*), rododendrons (*Rododendron*) were cut down and replaced with plantations of eucalyptus (*Eucalyptus*), cedar (*Cryptomeria*) and false camphor tree (*Cinamomum*).

At the end of the 80s, due to harsh social, economic and political situation in the country, plantations planted on the mentioned territories were cut down. In this degraded, empty and abandoned plots, certain cenotic groups, characterised with less stability, have started formation while considering competitive relationship between the local and alien origin species. The following vegetation species were recorded on the researched location (Table 1).

Table 1

Species composition of vegetation group created by a dominance of Japanese cedar (*Cryptomeria japonica*)

Species	Abundance	Species	Abundance
Charateristic species of groups (dominant species)			
Cryptomeria japonica (Thunb. ex L.f.) D.Don;	*5*	*Lonicera japonica Thunb*	*1*
Frangula alnus Mill	*1*	*Hydrocotyle ramiflora Maxim.*	*2*
Hedera colchica C. Koch.	*+*	*Hydrocotyle vulgaris L.*	*2*
Lespedeza bicolor Turc	*+*	*Smilax excelsa L.*	*1*
Associated species (companions)			
Acalypha australis L.	*+*	*Microstegium japonicum (Miq.) Koidz*	*1*
Ailanthus altissima (Mill.) Swingle	*1*	*Microstegium imberbe (Ness) Tzvel.*	*1*
Alnus glutinosa subsp. barbata (C.A.)	*1*	*Miscanthus sinensis Andersson*	*1*
Blechnum spicant (L.) Sm		*Osmunda regalis L.*	*+*
Carpinus caucasica Grossh (Carpinus betulus L.)	*+*	*Plantago major L*	*+*
Centaurium tenuiflorum (Hoffmanns. & Link)	*+*	*Poa annua L.*	*1*
Cinnamomum glanduliferum (Wall.) Meisn	*1*	*Poa compressa L*	*1*
Cinnamomum camphora (L.) J.Presl	*+*	*Prunella vulgaris L.*	*+*
Commelina communis L.	*1*	*Pteridium tauricum V.I. Krecz*	*1*
Corylus avellana L	*+*	*Pteris cretica L*	*+*
Dichroa febrifuga Lour.	*+*	*Quercus hartwissiana Stev.*	*+*
Erigeron annuus (L.) Pers	*+*	*Rhus japonica (Rhus javanica)*	*+*
Erigeron Canadensis L.	*+*	*Rubus caesius L.*	*+*
Eucalyptus viminalis Labill;	*1*	*Rubus serpens Weihe ex Lej.*	*+*
Euphorbia falcata L.	*+*	*Rumex acetosella L*	*+*
Euphorbia peplus L.	*+*	*Senecio sylvaticus L*	*+*
Euphorbia stricta L.	*+*	*Senecio vulgaris L.*	*+*
Fragaria vesca L	*+*	*Setaria faberi R.A.W.Herrm*	*+*
Hypericum androsaemum L	*+*	*Setaria intermedia Roem.et Schult.*	*+*
Juncus effusus L.	*1*	*Spiraea japonica L.f.*	*1*
Juncus tenuis Willd.	*1*	*Thelypteris oreopteris Sloss./ Oreopteris limbosperma Holub.*	*+*
Leontodon hispidus subsp. hastilis(L.) Corb.	*+*	*Trifolium diffusum Ehrh.*	*+*
Lespedeza striata (Thunb.) Hook. & Arn. (Kummerowia striata (Thunb.)	*1*	*Trifolium echinatum Bieb.*	*+*
Lysimachia japonica Thunb	*+*	*Vaccinium arctostaphylos L*	*+*
Mentha aquatic L.	*+*	*Verbascum blattaria L.*	*+*
Mentha pulegium L.	*+*	*Viola prionantha Bunge;*	*+*
Microstegium viminDicm (Trin.) A.	*1*	*Viola reichenbachiana Jord. ex Boreau*	*+*
Moss layer			
Calliergonella cuspidata (Hedw.) Loeske	*2*	*Polytrichum strictum Menzies ex*	*+*

		Brid.	
Odontoschisma denudatum (Nees) Dumort.	*2*		

According to the data, there are 65 species in the group of the Japanese cedar, where 33 are local and 32 alien origin. woody plants are presented with 15 species.

Phytocenological analysis: the main cover of the secondary phytocenosis is differentiated with layers. The first samples of Japanese cedar (*Cryptomeria japonica*) that survived from being cut down dominate the first sub-layer (average height 20-25 m). The second sub-layer is also outlined with self-cropped undergrowth samples and root sprouts found on cut logs of Japanese cedar, eucalyptus and false camphor tree. Greenbrier *(Smilax exselsa),* Japanese honeysuckle (*Lonicera japonica*), Persian ivy *(Hedera colchica)* from Liana genus create sub-forest group.

Grass cover (the third layer) is quite poorly developed. Projected coverage of grass is about 30-35%. The leading species are: Hydrocotyle ramiflora (*Hydrocotyle ramiflora*), annual bluegrass (*Poa annua*), Japanese clover (*Lespedeza striata*), diffuse clover (*Trifolium diffusum*), in open spaces added with early blossoming and forest viola (*Viola prionantha, Viola reichenbachiana*), Chinese foxtail (*Setaria faberi*), wild strawberry (*Fragaria vesca*), spurges (*Euphorbia*) and other. Bracken fern (*Pteridium tauricum*) is also abundantly presented.

Soil surface is covered with different species of mosses: *Calliergonella cuspidate, Odontoschisma denudatum, Polytrichum strictum.*

8 species are naturally renewed and engaged in creating of the basic layer of the given cenosis: *Cryptomeria japonica, Frangula alnus, Hedera colchica, Lespedeza bicolor, Lonicera japonica, Hydrocotyle ramiflora, Hydrocotyle vulgaris, Smilax excelsa* (Table 1). The local flora elements are presented through one or two units: oak (*Quercus hartwissiana*), hornbeam (*Carpinus caucasica*) and Caucasian whortleberry (*Vaccinium arctostaphylos*). A poor representation is probably caused, on the one hand, by shadowing created by the main cover of tree-plants layer and on the other hand, grazing by livestock animals. The following alien flora representatives are also poorly presented: camphor tree *(Cinnamomum camphora)* and tree of heaven (*Ailanthus altissima*). Based on analysis of the mentioned vegetation groupings, we may predict the phytocenosis role of the local flora will be increased.

The grouping describes East Asian origin, new in hydrangea genus, gone from culture specie *Dichroa febrifuga*

4.1.2. Vegetation group created by a dominance of eucalyptus (*Eucalyptus viminalis Labill., E. Globulus Labill., E. cinerea F.Muell. ex Benth.)*).

The research object is located in Kobuleti, on the left side of Kobuleti bypass road. The research object is flatland, within 9-18 m above sea level, GPS coordinates: T732846.16/4632983.63; T732633.16/46329008.23; T732632.61/4632844.06; T732669.55/4632817.34.

The inventory revealed vegetation group with a dominance of eucalyptus (*Eucalyptus viminalis, E. globulus, E. Cinerea)*. Specific and quantitative composition of the mentioned vegetation community differ from a vegetation community described with a dominance of the Japanese cedar (Table 2).

Table 2

Specific composition of the vegetation group created by a dominance of eucalyptus **(***Eucalyptus viminalis, E. globulus , E. cinerea***)**

Species	Abundance	Species	Abundance

Charateristic species of groups (dominant species)			
Eucalyptus globulus Labill	*2*	*Miscanthus sinensis Andersson*	*1*
Eucalyptus cinerea F. Muell. ex Benth	*2*	*Polygonum perfoliatum L.*	*+*
Eucalyptus viminalis Labill	*2*	*Paspalum paspalodes (Michx.) Scribn./ Paspalum distichum L*	*+*
Cinnamomum glanduliferum (Wall.) Meisn	*1*	*Kyllinga gracillima Miq*	*+*
Acacia dealbata Link	*1*	*Cyperus esculentus L.*	*+*
Frangula alnus Mill	*+*	*Lonicera japonica Thunb*	*+*
Associated species (companions)			
Aira elegans Willd	*+*	*Lobelia urens L*	*r*
Aleurites fordii Hemsl./Vernicia fordii (Hemsl.)	*+*	*Lolium perenne L.*	*+*
Alisma plantago-aquatica L.	*+*	*Lolium rigidum Gaudin*	*+*
Bellis perenis L	*+*	*Lotus palustris Willd*	*+*
Capsella bursa-pastoris (L.) Medik	*+*	*Lythrum salicaria L*	*+*
Cardamine hirsuta L	*+*	*Microstegium japonicum (Miq.) Koidz.*	*1*
Carex riparia Curt.	*+*	*Microstegium vimineicm (Trin.) A. Camus*	*1*
Castanea sativa Mill	*r*	*Myosotis palustris (L.) Nathh./Myosotis scorpioides L.*	*+*
Cichorium intybus L.	*+*	*Nasturtium officinale (L) R.Br*	*+*
Cinnamomum japonicum Siebold ex Nakai/ Cinnamomum tenuifolium (Makino)	*+*	*Oxalis corniculata L*	*+*
Conyzanthus graminifolius (Spreng.)/ Symphyotrichum graminifolium	*+*	*Paspalum thunbergii Kunth ex StDicd*	*+*
Corylus avellana L.	*r*	*Perila nankinensis (Lour.) Decne/ Plectranthus scutellarioides (L.) R.Br.*	*+*
Crepis setosa Haller f.	*+*	*Plantago major L*	*+*
Cryptomeria japonica (Thunb. ex L.f.) D.Don	*1*	*Poa annua L.*	*1*
Cyperus badius Poir	*+*	*Poa pratensis L.*	*+*
Cyperus longus L	*+*	*Polygonum thunbergii Siebold & Zucc.*	*1*
Daucus carota L.	*r*	*Polygonum hydropiper L./Persicaria hydropiper (L.)*	*+*
Duchesnea indica (Jacks.) Focke	*+*	*Prunella vulgaris L.*	*+*
Erigeron annuus (L.) Pers	*+*	*Pteridium tauricum V.I. Krecz*	*1*
Erigeron bonariensis L.	*+*	*Ranunculus muricatus L.*	*+*
Filago arvensis L	*+*	*Ranunculus sceleratus L.*	*+*
Filago gallica L.	*+*	*Rhododendron luteum Sweet.*	*r*
Frangula alnus Mill	*+*	*Rubus anatolicus Focke*	*+*
Galinsoga ciliata (Raf.)/ G. quadriradiata Ruiz & Pav	*+*	*Rubus hirtus auct./Rubus proiectus A.Beek*	*+*
Galinsoga parviflora Cav.	*+*	*Rumex pulcher L.*	*+*
Gnaphalium affine D.Don/Laphangium affine (D.Don) Tzvelev	*+*	*Sambucus ebulus L.*	*+*
Gnaphalium luteoalbum L./ Laphangium luteoalbum (L.) Tzvelev	*+*	*Senecio vulgaris L.*	*+*

Hedera colchica C. Koch.	*+*	*Setaria faberi R.A.W.Herrm*	*+*
Hydrocotyle ramiflora Maxim.	*1*	*Setaria intermedia Roem.et Schult.*	*+*
Hydrocotyle vulgaris L.	*1*	*Sisyrinchium septentrionale E.P.Bicknell*	*+*
Hypochaeris radiata Falk	*+*	*Smilax excelsa L.*	*+*
Juncus effusus L.	*+*	*Spiraea japonica L.f.*	*1*
Juncus tenuis Willd.	*+*	*Sporobolus fertilis (StDicd.) Clayton*	*+*
Lamium purpurDicm L.	*+*	*Typha angustifolia L.*	*+*
Lepidium campestre (L.) R. BR.	*+*	*Vaccinium arctostaphylos L*	*r*
Lespedeza striata (Thunb.) Hook. & Arn. /Kummerowia striata (Thunb.) Schindl.	*1*	*Vicia lathyroides L.*	*+*
Leucojum aestivum L.	*+*	*Vicia sativa subsp. cordata*	*+*
Moss layer			
Calliergonella cuspidata (Hedw.) Loeske	*2*	*Polytrichum strictum Menzies ex Brid.*	*+*
Odontoschisma denudatum (Nees) Dumort.	*2*	*Sphagnum cuspidatum Ehrh. ex Hoffm*	*1*

According to the data, there are 90 species in this vegetation group, where 36 are local and 54 of alien origin. Woody plants are presented with 17 species, the rest 73 are grass plants.

Phytocenological analysis:

The main cover of the phytocenosis is differentiated into two sub layers, the first sub-layer is formed with 20-30 m height eucalyptus (*Eucalyptus cinerea, Eucalyptus globulus, Eucalyptus viminalis*) survived from being cut down, that are dominant. Japanese cedar (*Cryptomeria japonica*), three species of eucapalyptus (*Eucalyptus cinerea, E. viminalis, E. globulus*), false camphor tree (*Cinnamomum glanduliferum),* Japanese camphor tree *(Cinnamomum japonicum)*, tung tree (*Aleurites fordii, A. cordata*), alder buckthorn (*Frangula alnus*), silver wattle (*Acacia dealbata*) are presented in the second sub-layer. Indigenous specie of sweet chestnut *(Castanea sativa)* is presented with few samples. Closure of the main cover is high and defined specific composition and structure of the vegetation.

Sub-forest (the second layer) is presented by liana genus. There are plants of greenbrier (*Smilax exselsa*), Japanese honeysuckle (*Lonicera japonica*), Persian ivy (*Hedera colchika*), and giant climbing tearthumb (*Polygonum perfoliatum*).

In this community, grass cover (the third layer) is distributed quite unevenly. In fact, it is developed in the open (free from sub-forest) places, where it reaches high projected coverage. The composition is colourful with indigenous and alien species as well. There are two species of paspalums (*Paspalum thunbergii, P. paspalodes*), Polygonum thunbergii (*Polygonum thunbergii*), three species of cyperus (*Cyperus esculentus, C. longus, C. badius*), pasture spikesedge (*Kyllinga gracillima*), goldenrod (*Solidago virgaurea*), rough-fruited buttercup *(Ranunculus muricatus*), celery-leaf buttercup (*Ranunculus sceleratus*) and many others (Table 2).

Soil surface is more or less covered with three species of moss (*Calliergonella cuspidata, Odontoschisma denudatum, Polytrichum strictum*), and the channels with sphagnum mosses (*Sphagnum cuspidatum*).

Species creating the main cover have week natural renewal capacity, reproduction is mainly carried through the self-crops and root sprouts.

New alien (European) origin species has been recording within this group - *Lobelia urens*.

4.1.3 Vegetation group with a dominance of false camphor (*Cinnamomum glanduliferum (Wall.) Meisn*) and Japanese cedar (*Cryptomeria japonica (Thunb. ex L.f.) D.Don*)

The research object is located in Kobuleti, on the right side of the Kobuleti bypass road. It is flatland, at 13-15 m above sea level, GPS coordinates: T 732747/4633247; T 732702/4633002; T 732986/4633080.

Recognition research was also carried on the location, transects were made in the different directions and recording of the specific composition of the secondary cenosis was also carried. Compared to the above objects, in this case composition is not rich, with poorly developed grass cover (Table 3). There are drainage pipes on the research object, with developed sphagnum mosses (*Sphagnum palustre*), knotweed (*Polygonum*), Japanese stiltgrass (*Microstegium*) and soft rush (*Juncus effusus*).

Table 3

Specific composition of the vegetation group created with a dominance of false camphor tree and (*Cinnamomum glanduliferum*) and Japanese cedar *(Cryptomeria japonica)*

Species	**Abundance**	**Species**	**Abundance**
Charateristic species of groups (dominant species)			
Eucalyptus cinerea F.Muell. ex Benth	*3*	*Cinnamomum glanduliferum (Wall.) Meisn*	*3*
Eucalyptus viminalis Labill	*3*	*Frangula alnus Mill*	*+*
Cryptomeria japonica (Thunb. ex L.f.) D.Don	*2*	*Lonicera japonica Thunb*	*+*
Associated species (companions)			
Alnus glutinosa subsp. barbata (C.A.Mey.)	*+*	*Poa annua L.*	*1*
Andropogon virginicus L		*Poa pratensis L.*	*1*
Carex remota L	*+*	*Polygonum hydropiper L./ Persicaria hydropiper (L.) Delarbre*	*+*
Cinnamomum japonicum Siebold ex Nakai (Cinnamomum tenuifolium (Makino) Sug.	*+*	*Polygonum perfoliatum L.*	*1*
Commelina communis L.	*1*	*Polygonum thunbergii Siebold & Zucc.*	*+*
Corylus avellana L.	*r*	*Polygonum persicaria L./ Persicaria maculosa Gray*	*+*
Erigeron annuus (L.) Pers	*+*	*Pteridium tauricum V.I. Krecz*	*1*
Erigeron Canadensis L.	*+*	*Rhododendron luteum Sweet*	*r*
Eucalyptus globulus Labill	*1*	*Rhododendron ponticum L*	*r*
Hydrocotyle ramiflora Maxim.	*+*	*Rubus anatolicus Focke*	*+*
Hydrocotyle vulgaris L.	*+*	*Rubus hirtus auct./Rubus proiectus A.Beek*	*+*
Juncus effuses L.	*+*	*Rumex acetosella subsp. acetoselloides (Balansa) Den Nijs/ R. acetoselloides*	*+*
Miscanthus sinensis Andersson	*+*	*Senecio vulgaris L.*	*+*
Microstegium viminDicm (Trin.) A.Camus	*+*	*Smilax excelsa L.*	*+*
Nymphaea sp.	*r*	*Spiraea japonica L.f.*	*+*
Osmunda regalis L	*r*	*Thelypteris palustris (A. Gray)*	*+*

		Schott /Thelypteris confluens (Thunb.) C.V.	
Oxalis corniculata L	+	*Thelypteris oreopteris Sloss./ Oreopteris limbosperma Holub.*	+
Plantago major L	+	*Vaccinium arctostaphylos L*	r
Moss layer			
Sphagnum palustre L	+	*Calliergonella cuspidata (Hedw.) Loeske*	2
Odontoschisma denudatum (Nees) Dumort.	2	*Polytrichum strictum Menzies ex Brid*	+

There are 46 species presented on the research object. The group is presented with 25 indigenous species, the rest 21 is of alien origin. In contrast to the above mentioned cenosis, in this group we observed Pontic rhododendron (*Rhododendron ponticum*), invasive - broomsedge bluestem (*Andropogon virginicus*).

Phytocenological analysis:

According to the research, phytocenosis is differentiated by the layers. 20-30 meter eucalyptus trees of two species (*Eucalyptus cinerea, E. viminalis*) dominate the vegetation community in the first layer. The second sub-layer is also outlined with on average 10-20 m height, created by Japanese cedar (*Cryptomeria japonica*) and false camphor tree (*Cinnamomum glanduliferum*). The third sub-layer is represented by the 4-8 m height root sprouts of Japanese cedar, false camphor tree, alder-tree and eucalyptus.

Sub-forest (the second layer) is unevenly developed, represented by bushes of hazel (*Corylus avelana*), pontic rhododendron (*Rhododendron ponticum*), alder buckthorn (*Frangula alnus*) and other. From liana genus, here also we observe greenbrier (*Smilax exselsa*), Japanese honeysuckle (*Lonicera japonica*), evergreen Persian ivy (*Hedera colchika*) vined on the soil surface.

Grass cover (the third layer) is weakly developed, species composition is poor caused by strong shadowing. Indigenous and alien species are observed in the flora.

Like the previous cenosis, soil surface is more or less covered with mosses (*Calliergonella cuspidate, Odontoschisma denudatum, Polytrichum strictum*), and channels with sphagnum moss (*Sphagnum palustre*). Ferns are poorly presented with few units of *Thelypteris palustris/Thelypteris confluens* and *Thelypteris oreopteris Sloss./Oreopteris limbosperma*, while *Pteridium tauricum* creates unfordable groups.

Natural renewal of the species creating the main cover is weak, reproduction is mainly carried with self-crops and root sprouts.

Recorded vegetation groups – 1) Japanese cedar (*Cryptomeria japonica*) dominant, 2) eucalyptus (*Eucalyptus viminalis, E. globulus, E. cinerea*) dominant, 3) Vegetation group with a dominance of false camphor tree (*Cinnamomum glanduliferum*) and Japanese cedar (*Cryptomeria japonica*), differ in a number of local and alien origin species. Because of disposition of leaves in the eucalyptus group, shadow is weaker, thus it is distinguished by a higher number of species, represented by 36 local and 54 alien species. There are unfavourable conditions for species to spread in the rest two groups, thus it is represented with a lower number of species. Number of species in the Japanese cedar group is particularly the same with 33 local and 32 alien species. While in the Japanese cedar and false camphor tree group there are 25 local and 21 alien species. Although, the local species were cut down and plantations of alien origin species were created in the recorded objects, there are still indigenous ligneous species – hazel (*Corylus avellana*), alder buckthorn (*Frangula alnus*), Caucasian whortleberry (*Vaccinium arctostaphylos*), greenbrier (*Smilax excelsa*), Strandzha oak (*Quercus hartwissiana*), European hornbeam

(*Carpinus betulus*), sweet chestnut (*Castanea sativa*), Persian ivy (*Hedera colchica*) and others. Described landscape structures are formed with participation of local and alien species. In all three cenoses, the Japanese honeysuckle (*Lonicera japonica*) wraps around tree plants and bushes and significantly hinders their development. Grass cover is mostly developed within species compositions of the upper layers and covers, however, in so called 'open windows' we observe Chinese silver grass (*Miscanthus sinensis*), which limits penetration and development of other species.

As mentioned by M. Davitadze, successional events have started in the Kolkheti lowland in ancient times. It is long-term process, which is still ongoing as confirmed by our records and research.

4.1.4. Vegetation group with created by a dominance of Japanese timber bamboo (*Phyllostachys bambusoides Siebold & Zucc.)*.

Vegetation group with a dominance of bamboo – Japanese timber bamboo (*Phyllostachys bambusoides)* is located in Tsikhitsdziri village, Kobuleti, on the left side of Kobuleti-Batumi linking road, on the slope facing the sea, within 20-30 m above sea level. GPS coordinates: T729197/4628234; T729134/4628113; T 729222/4628217; T 729175/4628088.

Soil is poorly developed in the research object. The principal part of the territory is covered with bamboos of *Phyllostachys bambusoides* (coverage coefficient 5), there is also another specie of bamboo - *Pseudosasa hindsii* (coverage coefficient +), characterised with narrower, mosaic distribution.

Ligneous plants are presented with few units of Maritime pine - *Pinus pinaster* (coverage coefficient r), which is quit fruit-bearing plant giving self-crops, but sprouts and growing stems could not compete with bamboo planted places and die. Another invasive specie - black locust *Robinia pseudoacacia* (coverage coefficient r) is also engaged in the mentioned group. Black locust blossoms, bears fruits and gives self-crops. It expands its coverage area mainly in open spaces. Within bamboo plantations, self-crops and root sprouts and die soon. In the secondary phytocenosis they are presented with two invasive species – tree of heaven/*Ailanthus altissima* (coverage coefficient r) and Chinese sumac/ *Rhus javanica* (coverage coefficient r).

Local origin ligneous plants – alder tree and chestnut were expelled from the bamboo group. There are few fruit-bearing units of those species. In open places, there are alder buckthorn -*Frangula alnus* (coverage coefficient r), two species of blackberry- *Rubus anatolicus, R. hirtus/R. proiectus* (coverage coefficient r), greenbrier -*Smilax excelsa* (coverage coefficient r), Japanese honeysuckle - *Lonicera japonica* (coverage coefficient r). Invasive potential of bamboo is quite high, abundance is also high, which create phytocenotic barrier for all other plants. In the cenosis area, 48 species of grass plants were recorded in the open places represented with high frequency, but they could not penetrate deeper in the group (the dissertation gives a full list).

Development of grass plants is hindered with leaves fallen from bamboos. Even though, the upper side of the object is covered with windshield zone of fruit bearing bamboos, there are no self-crops of them. This bamboo group is not differentiated by layers. This type of bamboo (*Phyllostachys bambusoides*) is quite aggressive by nature and has huge potential for spreading.

Mosses recorded on the object are - *Conocephalum conicum* (coverage coefficient +).

4.1.5. Vegetation group with a dominance of the moso bamboo (*Phyllostachys edulis (Carrière) J.Houz*)

Vegetation group with a dominance of the moso bamboo *(Phyllostachys edulis)* is located in Tsikhistsdziri village, on slope facing the sea, at 30-50 m above sea level. Background recording was carried on 0.45 ha, on 35 degree inclined slope. GPS coordinates taken from the object centre are T 728729/4627351.

Bamboo *Phyllostachys edulis* (coverage coefficient 5) dominates the mentioned object, grass cover is not particularly formed. Few units of following ligneous species have been recorded cherry laurel - *Laurocerasus officinalis/Prunus laurocerasus* (coverage coefficient r), Pontic rhododendron - *Rhododendron ponticum* (coverage coefficient r), tulip tree - *Liriodendron tulipifera* (coverage coefficient r), hazel -*Corylus avellana* (coverage coefficient r), European hop-hornbeam -*Ostrya carpinifolia* (coverage coefficient r), Pontic daphne -*Daphne pontica* (coverage coefficient r). From lianas we observe few examples of Japanese honeysuckle (*Lonicera japonica*), greenbrier (*Smilax exselsa*), blackberry (*Rubus*), Persian ivy (*Hedera*). Despite an aggressive nature of the mentioned lianas, their phytocenotic potential in this group is insignificant. The same goes for French hydrangea (*Hydrangea macrophylla*) and the Japanese meadowsweet (*Spiraea japonica*).

Mosses are represented by: *Conocephalum conicum* და *Odontoschisma denudatum*. Ferns by hart's-tongue (*Phyllitis scolopendrium/Asplenium scolopendrium*) and scaly buckler (*Dryopteris remota)*. Coverage coefficient for all of them is r.

In so called 'open windows' free from bamboos, other grass plants are widely represented: *Acalypha australis., Erigeron annuus., E. Canadensis, Perilla nankinensis/Plectranthus scutellarioides, Euphorbia falcata, E. peplus, Fragaria vesca, Hydrocotyle ramiflora, H. vulgaris, Juncus effusus, Polygonum perfoliatum* and many others, which are represented quite abundantly, but they cannot penetrate bamboo groups. The grass cover is characterised with uneven and mosaic distribution. There are also *Alnus glutinosa subsp. barbata and Frangula alnus* from the grass plants.

According to the literature sources and our research, both recorded groups of bamboos are characterised with high invasive potential. It creates phytocenic barrier for all other local and adventive species. They are characterised with rapid growth, area expansion, they conquer new territories and expel other species. They have vegetative reproduction, with strongly developed roots on and deep in the ground.

4.1.6. Vegetation group with a dominance of bamboo-leaf oak (*Quercus myrsinifolia Blume*), black alder (*Alnus glutinosa subsp. Barbata (C.A.Mey.) Yalt.,*) and Japanese cedar *Cryptomeria japonica (Thunb. ex L.f.) D.Don*)

The research object is located in pichvnari, on the left side of Choloki river and Poti-Kobuleti road. In 1 km distance from the sea. Within 0-1 m above sea level, the place is flatland, GPS coordinates T 730279/4642031; T 730281/4641997; T 730358/4641999; T 730367/4642069; T 730318/4642076; T 730320/4642031.

The soil is well developed. There was nursery of decorative plants in the mentioned territory in 1950s, which has influenced specific composition of this cenosis. It is wetland, with frequent cases of water covering the ground.

The recording revealed the vegetation group with a dominance of Japanese evergreen bamboo-leaf oak (*Quercus myrsinifolia*), and Japanese cedar (*Cryptomeria japonica)* and also, black alder (*Alnus glutinosa subsp. barbata*), which is widespread in our local vegetation. The hydrophilic and sciophyte species (*Asplenium scolopendrium, Equisetum palustre, Osmunda regalis, Veronica anagalis – aquatica and other*) are also represented in this vegetation (Table 4).

Table 4.

Vegetation group with a dominance of evergreen bamboo-leaf oak (*Quercus myrsinifolia*), black alder (*Alnus glutinosa subsp. barbata*) and Japanese cedar (*Cryptomeria japonica)*.

Species	**Abu nda**	**Species**	**Abu nda**

	nce		nce
Charateristic species of groups (dominant species)			
Quercus myrsinifolia Blume	*3*	*Polygonum thunbergii Siebold & Zucc.*	*2*
Alnus glutinosa subsp. barbata (C.A.Mey.) Yalt.	*2*	*Equisetum palustre L*	*+*
Cryptomeria japonica (Thunb. ex L.f.) D.Don	*1*	*Juncus effuses L.*	*1*
Platanus occidentalis L	*+*	*Asplenium scolopendrium L. (Phyllitis scolopendrium (L.)*	*+*
Polygonum perfoliatum L (Persicaria perfoliata (L.)	*+*		
Associated species (companions)			
Acer negundo L.	*+*	*Microstegium japonicum (Miq.) Koidz.*	*+*
Acalypha australis L.	*1*	*Miscanthus sinensis Andersson*	*1*
Ajuga reptans L.	*+*	*Myosotis palustris(L.)Nathh. /Myosotis scorpioides*	*+*
Ambrosia artemisiifolia L.	*+*	*Osmunda regalis L.*	*+*
Angelica sylvestris L.	*1*	*Oxalis corniculata L*	*+*
Arthraxon hispidus (Thunb.) Makino	*+*	*Oxalis violacea L.*	*+*
Bidens cernua L.	*+*	*Perilla nankinensis Wender. (Plectranthus scutellarioides (L.)*	*+*
Capsella bursa-pastoris (L.) Medik.	*1*	*Phytolacca americana L.*	*+*
Cardamine hirsute L	*+*	*Pinus pinaster Aiton*	*r*
Cardamine parviflora L	*1*	*Pinus taeda L.*	*r*
Commelina communis L	*2*	*Plantago major L*	*+*
Cyperus badius Poir.	*1*	*Polygonum posumbu Buch.-Ham. ex*	*+*
Cyperus difformis L.	*1*	*Potentilla reptans L.*	*+*
Dryopteris remota (A. Braun) Hayek	*+*	*Prunella vulgaris L.*	*+*
Equisetum arvense L.	*+*	*Pteridium tauricum V.I. Krecz*	*+*
Eleusine indica (L.) Gaertn	*+*	*Pteris cretica L*	*+*
Ficaria popovii A.P. Khokhr.	*1*	*Quercus acutissima Carruth*	*1*
Glechoma hederacea L.	*+*	*Quercus palustris Münchh*	*1*
Hedera helix L	*+*	*Ranunculus muricatus L.*	*+*
Hedera colchica (K.Koch) K.Koch	*+*	*Ranunculus sceleratus L.*	*+*
Hydrangea macrophylla (Thunb.) Ser.	*+*	*Rosa multiflora Thunb.*	*2*
Hydrocotyle ramiflora Maxim.	*1*	*Rubus anatolicus Focke*	*1*
Hydrocotyle vulgaris L.	*1*	*Rubus hirtus auct./Rubus proiectus A.*	*1*
Juglans ailanthifolia Carrière	*+*	*Rumex acetosella subsp. acetoselloides (Balansa) Den Nijs/ R. acetoselloides*	*+*
Juglans ailantifolia var. cordiformis	*+*	*Sigesbeckia orientalis L.*	*+*
Juncus bufonius L.	*+*	*Smilax excelsa L.*	*1*
Leucojum aestivum L	*1*	*Stellaria media (L.) Vill*	*+*
Ligustrum japonicum Thunb	*r*	*Thelypteris limbosperma (All.) H.P.*	
Lonicera japonica Thunb	*+*	*Trifolium diffusum Ehrh.*	*+*

Luzula forsteri (Sm.) DC	+	*Trifolium echinatum Bieb.*	+
Lysimachia japonica Thunb	+	*Urtica dioica L*	+
Mentha aquatica L.	+	*Veronica anagalis –aquatica L*	+
Mentha pulegium L.	+	*Veronica persica Poir*	+
Moss layer			
Calliergonella cuspidata (Hedw.) Loeske	*2*	*Fissidens sp.*	+
Odontoschisma denudatum (Nees) Dum.	*2*	*Polytrichum strictum Menzies ex Brid.*	+

There are 79 species in this group, 37 local and 42 alien origin species. Ligneous plants are represented by 13 species.

Phytocenological analysis:

Phytocenosis is differentiated by layers. It is rich with vining plants, like: Japanese honeysuckle *(Lonicera japonica),* polygonum (*Polygonum perfoliatum*), Colchis and Persian ivy (*Hedera helix, H. colchica*) and greenbrier (*Smilax excelsa*).

Phytocenosis is differentiated by two layers. According to the research results, specific composition of the phytocenosis is rich and diverse. The first layer is composed of bamboo-leaf, sawtooth and swamp Spanish oaks (*Quercus myrsinifolia, Q. acutissima, Q. palustris*), black alder (*Alnus glutinosa subsp. barbata*), Japanese cedar (*Cryptomeria japonica*), American sycamore (*Platanus occidentalis*), maritime and loblolly pines (*Pinus pinaster, P. taeda*). The second layer is represented by the Japanese walnut and heartnuts (*Juglans ailanthifolia, J. ailantifolia var. cordiformis*), Japanese privet (*Ligustrum japonicum*). Persian ivy, blackberry and polygonum species make vegetation community impenetrable.

There are 4 species of mosses (*Calliergonella cuspidata, Odontoschisma denudatum, Fissidens sp., Polytrichum strictum*), 4 species of ferns (*Osmunda regalis, Pteridium tauricum, Pteris cretica, Thelypteris limbosperma,*) and 2 species of horsetails (*Equisetum palustre, E. arvense*), characterised for wetland ecotype.

According to observations, alien plants are actively engaged in creation of the secondary cenosis, those species grow well, blossom, bear-fruit, give self-crops and root sprouts, go wild and oppress local flora species in the secondary cenosis within local climate conditions.

Introduced and adventive alien species are characterised with abundant, regular fruit-bearing and well reproduction, rapid growth and high invasive potential.

Adaptation potential of wild introductions, invasive species complies with the abiotic and biotic characteristics of the region, they invade and settle the phytocenosis and promote its transformation.

4.2. The secondary phytocenosis of Chakvi lowland

Tea plantations are research objects. Chakvi used to be one of the first centres of Georgian tea-growing. In 1885, engineer-colonel Alexander Solovtcev, cultivated tea plantation on 1,5 ha near the Chakvi station. In 1880s, Popov, cultivated plantations of Chinese tea on 14 ha territory of Chakvi, Kapreshumi and Salibauri. In 1899, he also built a tea processing factory equipped with English equipment. In 1895, the Prince Community cultivated tea plantation on 16 ha in Chakvi. Invasion of many alien species in the seaside Ajara was directly related to cultivations of the tea plantations.

At the end of the XX century, after tea plantations were considered as non-profitable culture, agro technical and other activities were stopped, along with grass cover, few number of local and more widely alien dendro species have started spreading in the abandoned tea plantations. Thus, we set a goal to study

this vegetation group, where completely new vegetation communities, developing secondary phytocenosis were created based on alien species with participation of bushes and grass plants.

Based on coverage observation, we allocated research territories, pointed out locations and carried recordings according to the structure of the research object and research methodology.

Four vegetation groups were defined in the Chakvi lowland and surrounding hills and hillocks:

1. Vegetation group with a dominance of the Japanese cedar (*Cryptomeria japonica*).
2. Vegetation group with a dominance of hornbeam and oaks (*Carpinus caucasica, Quercus palustris, Quercus falcata*).
3. Vegetation group with a dominance of hornbeam and the Japanese cedar (*Carpinus caucasica, Cryptomeria japonica*).
4. Vegetation group with a dominance of black alder, Japanese meadowsweet and American pokeweed (*Alnus glutinosa subs barbata, Spiraea japonica, Phytolacca americana*).

4.2.1. Vegetation group created by a dominance of the Japanese cedar (*Cryptomeria japonica (Thunb. ex L.f.) D.Don.)*

This object is located in Chakvi. At 52-29 m above sea level. Three-point transects were marked on the object (37 T 727028.30m E 4620259.34m N; 37 T 726988.28m E 4620337.24m N; 37 T 726960.42m E 4620413.57m N;) where carry to geo-botanical recordings.

Exposition is inclined; the object is represented with red soil and quite thin humus surface. The research territory is bordered with windshield zone created by the Japanese cedar, which is abundantly fruit-bearing, giving self-crops and dominates the research object.

As mentioned in the beginning, in the recent past local flora representatives were cut down – the Oriental beech (*Fagus orientalis*), sweet chestnut (*Castanea sativa*), hornbeam (*Carpinus caucasica)*, Strandzha oak (*Quercus hartvisiana*), linden (*Tilia caucasica*), Caucasian walnut (*Pterocarya pterocarpa*), date-plum (*Diospyros lotus*), yellow azalea (*Rhododendron luteum Sweet*), Pontic rhododendron (*Rhododendron ponticum*) and tea plantations were cultivated on the mentioned territory, but as agro technical activities were stopped in the plantations, agro cenosis was degraded, covered with ferns, with species of blackberry, greenbrier and polygonums. Tea bushes in the transformed secondary cenosis are nearly dried out, only with limited weak vegetation and regeneration ongoing processes.

In this degraded and abandoned territories, within competition of indigenous and alien species, certain cenosis structures have been gradually formed with more or less stability, which ensures co-existence of indigenous and alien species (in the general vegetation community) (Table 5).

Table 5

Specific composition of vegetation group created with a dominance of Japanese cedar (*Cryptomeria japonica*)

Species	**Abundance**	**Species**	**Abundance**
Charateristic species of groups (dominant species)			
Cryptomeria japonica (Thunb. ex L.f.) D.Don	4	*Poa annua L.*	*1*
Thea sinensis L./ Camellia sinensis (L.) Kuntze	*3*	*Rubus caesius L.*	*2*
Pteridium tauricum V.I. Krecz	*3*	*Rubus hirtus W.et.K*	*2*
Associated species (companions)			
Acalypha australis L.	*+*	*Mentha pulegium L.*	*+*
Acer negundo L.	*r*	*Microstegium imberbe (Ness) Tzvel.*	*+*

Acer pseudoplatanus L.	*r*	*Microstegium japonicum (Miq.) Koidz*	*+*
Ailanthus altissima (Mill.) Swingle	*r*	*Miscanthus sinensis Andersson*	*r*
Aira elegans Willd	*+*	*Oxalis corniculata L*	*+*
Aleurites fordii Hemsl./ Vernicia fordii (Hemsl.)	*r*	*Paspalum dilatatum Poir.*	*+*
Alnus glutinosa subsp. barbata (C.A.Mey.) Yalt.	*r*	*Phytolacca americana L.*	*+*
Angelica sylvestris ssp. pachyptera Nym.	*+*	*Plantago major L*	*+*
Bifora radians Bieb.	*+*	*Poa pratensis L.*	*+*
Castanea sativa Mill	*r*	*Polygonum perfoliatum L.*	*2*
Commelina communis L	*+*	*Potentilla reptans L.*	*+*
Corylus avellana L.	*r*	*Prunella vulgaris L.*	*+*
Crassocephalum crepidioides (Benth.) S.Moore	*1*	*Rubus serpens Weihe ex Lej. & Cour*	*+*
Digitaria sanguinalis (L.) Scop.	*+*	*Rumex acetosella L*	*+*
Dryopteris remota (Döll) Druce	*r*	*Rumex acetosella subsp. acetoselloides (Balansa) Den Nijs/ R. acetoselloides*	*+*
Erigeron annuus (L.) Pers	*+*	*Rumex pulcher L.*	*+*
Erigeron bonariensis L	*+*	*Sambucus ebulus L.*	*+*
Erigeron Canadensis L.	*+*	*Sambucus nigra L.*	*+*
Euphorbia falcata L.	*+*	*Senecio sylvaticus L*	*+*
Euphorbia peplus L.	*+*	*Senecio vulgaris L.*	*+*
Euphorbia stricta L.	*+*	*Setaria faberi R.A.W.Herrm*	*+*
Fragaria vesca L	*1*	*Setaria glauca (L.)P.B.*	*+*
Frangula alnus Mill	*+*	*Setaria intermedia Roem.et.Schult*	
Hydrangea macrophylla (Thunb.)	*r*	*Smilax excelsa L.*	*1*
Hydrocotyle ramiflora Maxim.	*1*	*Sonchus oleracDics L.*	*+*
Hydrocotyle vulgaris L.	*1*	*Spiraea japonica L.f.*	1
Hypericum mutilum L	*+*	*Trifolium diffusum Ehrh.*	*+*
Hypochaeris radicata L	*+*	*Trifolium echinatum Bieb.*	*+*
Juncus effusus L.	*r*	*Viola prionantha Bunge;*	*+*
Juncus tenuis Willd.	*r*	*Verbena officinalis L*	*+*
Lonicera japonica Thunb	*1*	*Veronica persica Poir./V. tournefortii*	*+*
Lysimachia japonica Thunb	*+*		
Mosses			
Polytrichum strictum	*+*	*Calliergonella cuspidata (Hedw.) Loeske*	*+*

There are in total 71 species, 30 local and 41 alien origin, recorded in the given vegetation group.

Phytocenological analysis:

Tree layer of the phytocenosis is in formation-developing process. The tree layer is differentiated with two sub-layers. The first sub-layer is dominated by 8-10 m height plants of the Japanese cedar (*Cryptomeria japonica*). The second sub-layer is also outlined in 3-6 m, presented by few examples of

oaks (*Quercus falcata, Q. palustris*), the tung tree (*Aleurites fordii*) and boxelder maple (*Acer negundo*). Local ligneous species are represented by sweet chestnut (*Castanea sativa*).

Indigenous species carry strong positions in the sub-forest. It is created by various species of blackberry (*Rubus caesius, R. hirtus, R. serpens*), there also are alder buckthorn (*Frangula alnus*), elderberry (*sambucus nigra*) and common hazel (*Corylus avellana*). There are a lot of lianas: greenbrier (*Smilax exselsa*), Japanese honeysuckle (*Lonicera japonica*), giant climbing tearthumb (*Polygonum perfoliatum*).

Grass cover (the third layer) is poorly developed. Leading species are indigenous (*Pteridium tauricum, Plantago major* etc.), as well as, adventive (*Microstegium imberbe, Microstegium japonicum, Miscanthus sinensis, Paspalum dilatatum* and other). Bracken fern (*Pteridium tauricum*) covers tea bushes.

There are two species of mosses (*Polytrichum strictum, Calliergonella cuspidata*) observed in relatively open places of the group.

Natural restoration of species creating the main cover of the forming secondary phytocenosis is weak. The cenosis is represented by seedlings and different height growing plants.

4.2.2. The vegetation group created by a dominance of hornbeams and oaks (*Carpinus caucasica Grossh.*, *Quercus palustris Münchh.*, *Quercus falcata Michx.*)

The mentioned object is located nearby to the above mentioned cenosis, at 38-59 above sea level.

The recoding revealed the vegetation group with a dominance of three leafy plants hornbeam (*Carpinus caucasica),* swamp Spanish oak and Southern red oak *(Quercus palustris, Q. falcata)*

The specific and quantitative composition of the mentioned vegetation group differs from the group created by the Japanese cedar dominance (Table 6).

Table 6

Specific composition of the vegetation group created by a dominance of hornbeam (*Carpinus caucasica),* swamp Spanish oak and Southern red oak *(Quercus palustris, Q. falcata)*

Species	**Abundance**	**Species**	**Abundance**
Charateristic species of groups (dominant species)			
Carpinus caucasica Grossh (C. betulus L.)	2	*Rubus caesius L.*	2
Quercus palustris Münchh.	2	*Rubus hirtus W.et.K*	2
Quercus falcata Michx.	2	*Pteridium tauricum V.I. Krecz*	3
Thea sinensis L./Camellia sinensis (L.) Kuntze	3	*Polygonum perfoliatum L.*	2
Frangula alnus Mill	1	*Spiraea japonica L.f.*	+
Rhododendron luteum Sweet	+		
Associated species (companions)			
Acalypha australis L.	+	*Oxalis corniculata L*	*1*
Ailanthus altissima (Mill.) Swingle	+	*Paspalum dilatatum Poir.*	+
Aira elegans Willd	+	*Paspalum paspaloides (Mich[.) Scrbn*	+
Aleurites fordii Hemsl./Vernicia fordii (Hemsl.)	+	*Perilla nankinensis Wender. (Plectranthus scutellarioides (L.) R.Br.)*	+

Alisma plantago-aquatica L.	+	*Phytolacca americana L.*	*1*
Alnus glutinosa subsp. barbata (C.A.Mey.) Yalt.	*1*	*Plantago major L*	+
Anthoxanthum odoratum L	+	*Poa annua L.*	*1*
Arctium lapa L.	+	*Poa pratensis L.*	*1*
Bellis perenis L	*1*	*Poa trivialis L*	+
Bidens cernua L.	*1*	*Polygonum aviculare L*	+
Calystegia sylvestris (Wild) Roem.et Schult./C.silvativa		*Polygonum minus Huds*	+
Cardamine hirsuta	+	*Polygonum thunbergii Siebold & Zucc.*	+
Castanea sativa Mill	*r*	*Potentilla reptans L.*	+
Cedrus deodara (Roxb. ex D.Don) G.Don	+	*Prunella vulgaris L*	+
Cerastium glomeratum Thuill	+	*Prunella vulgaris L.*	+
Chamaecyparis lawsoniana (Andr.) Parl.	+	*Quercus acutissima Carruth*	1
Cinnamomum glanduli-ferum (Wall.) Meisn	+	*Quercus glauca Thunb.*	1
Commelina communis L	*1*	*Quercus myrsinifolia Blume*	1
Convolvulus arvensis L.	+	*Ranunculus muricatus L.*	+
Corylus avellana L.	*r*	*Rhododendron ponticumL*	+
Crassocephalum crepidioides (Benth.) S.Moore	*1*	*Rhus javanica L/ Brucea javanica (L.)*	1
Cryptomeria japonica (Thunb. ex L.f.) D.Don	1	*Robinia pseudoacacia L.*	*1*
Digitaria sanguinalis (L.) Scop.	+	*Rubus serpens Weihe ex Lej.*	*1*
Dryopteris remota (Döll) Druce	+	*Rumex acetosella L*	+
Duchesnea indica (Jacks.) Focke	+	*Rumex acetosella subsp. acetoselloides (Balansa) Den Nijs/ R. acetoselloides*	+
Erigeron annuus (L.) Pers	+	*Rumex pulcher L.*	+
Erigeron bonariensis L	+	*Sambucus ebulus L.*	+
Erigeron Canadensis L.	+	*Sambucus nigra L.*	+
Euphorbia falcata L.	+	*Scrophularia nodosa L.*	+
Euphorbia peplus L.	+	*Senecio sylvaticus L*	+
Euphorbia stricta L.	+	*Senecio vulgaris L.*	+
Filago gallica L.	+	*Setaria faberi R.A.W.Herrm*	+
Fragaria vesca L.	+	*Setaria glauca (L.)P.B.*	+
Galinsoga ciliata (Raf.) S.F.Blake /Galinsoga quadriradiata Ruiz & Pav.	+	*Setaria intermedia Roem.et Schult.*	+
Galium humifusum M.Bieb	+	*Sigesbeckia orientalis L.*	+
Glechoma hederacea L	+	*Sisyrinchium septentrionale E.P.Bicknell*	+
Hedera colchica C. Koch.	+	*Smilax excelsa L.*	*1*
Hydrocotyle ramiflora Maxim.	*1*	*Solanum carolinense L*	+
Hydrocotyle vulgaris L.	*1*	*Solanum nigrum L./ Solanum americanum Mill.*	+
Hypochaeris radicata L	+	*Sonchus oleracDics L.*	+
Hypericum mutilum L	+	*Sporobolus fertilis (StDicd.) Clayton*	+
Juncus effusus L.	+	*Stellaria media (L.) Vill*	+
Juncus tenuis Willd.	+	*Trifolium diffusum Ehrh.*	+

Kyllinga gracillima Miq	*1*	*Trifolium campestre Schreb*	*+*
Laurocerasus officinalis M.Roem. /Prunus laurocerasus L.	*r*	*Trifolium repens L*	*+*
Lonicera japonica Thunb	*2*	*Trifolium echinatum Bieb.*	*+*
Luzula forsteri (Sm.) DC	*+*	Vaccinium arctostaphylos	*+*
Lysimachia japonica Thunb	*+*	*Verbena officinalis L*	*+*
Mallotus japonicus (L.f.) Müll.Arg.	*+*	*Veronica persica Poir*	*+*
Mentha pulegium L.	*+*	*Vicia angustifolia Reichard /sativa subsp. nigra (L.) Ehrh.*	*+*
Microstegium imberbe (Ness) Tzvel.	*+*	*Vicia sativa subsp. cordata*	*+*
Microstegium japonicum (Miq.) Koidz	*1*	*Viola prionantha Bunge;*	*+*
Miscanthus sinensis Andersson	*+*	*Veronica anagalis aquatic L.*	*+*
Moss layer			
Calliergonella cuspidata (Hedw.) Loeske	+	Polytrichum strictum	+

There are in total 119 species recorded, 48 local and 71 alien origin. Ligneous plants are represented by 26 species, 10 local (*Alnus glutinosa subsp. barbata, Carpinus caucasica, Castanea sativa, Corylus avellana, Frangula alnus, Laurocerasus officinalis, Rhododendron luteum Sweet, R. ponticum, Vaccinium arctostaphylos*, *Sambucus nigra*) and 16 alien species (*Ailanthus altissima, Aleurites fordii, Cedrus deodara,* Chamaecyparis lawsoniana, *Cinnamomum glanduliferum, Cryptomeria japonica, Quercus acutissima, Q. falcata, Q. myrsinifolia, Q. glauca, Q. palustris, Mallotus japonicus, Rhus javanica, Robinia pseudoacacia, Spiraea japonica, Thea sinensis*).

Phytocenological analysis:

Tree layers ae not differentiated by sub-layers. European hornbeam (*Carpinus caucasica*), swamp Spanish oak and Southern red oak *(Quercus palustris, Q. falcata)* are dominant with a coverage coefficient 2. There are few examples of other tree plants (*Cryptomeria japonica, Chamaecyparis lawsoniana, Quercus acutissima, Quercus glauca, Quercus myrsinifolia and other).* Positions of the indigenous species in so called sub-forests are quite strong. The most of the territory is covered with blackberry (*Rubus caesiu, R. hirtus, R. Serpens*) and there are other indigenous representatives as well (*Rhododendron luteum Sweet, Rh. ponticumL, Sambucus ebulus, S. nigra* and other). From lianas the Japanese honeysuckle (*Lonicera japonica*), giant climbing tearthumb (*Polygonum perfoliatum*), greenbrier (*Smilax exselsa*), Persian ivy (*Hedera colchika*) are worth mentioning.

The grass cover is characterised by diversity, coverage is high, particularly, in windows and places free from sub-forests. The composition includes local and alien species as well. Abandoned tea bushes are covered with bracken fern (*Pteridium tauricum*).

American pokeweed (*Phytolacca americana*) is highly represented. Compared to the Japanese cedar dominant group, in this mentioned group deciduous tree plants are dominant. Diversity of grass plants species is also visible.

Based on the results of the recordings, compositional diversity of ligneous plants in this vegetation group is probably caused by neighbouring different vegetation groups, including, species invading from the Batumi Botanical Garden with significant role in cenosis (structural) in some of them.

Dominance of hornbeam, abundance of rhododendrons, Persian ivy, greenbrier, alder buckthorn, cherry laurel and local grass species in this cenosis and appearing of plants characterised for the primary cenosis, gives an opportunity for partial restoration of the initial conditions of phytocenosis.

4.2.3. Vegetation group created with a dominance of hornbeam (*Carpinus caucasica Grossh.*) and the Japanese cedar (*Cryptomeria japonica (Thunb. ex L.f.) D.Don*)

The mentioned object is located in Chakvi, on the right side of Chakvi-Batumi road, in the abandoned territory of tea plantation, at 32-52 m above sea level, GPS coordinates 37 T 727554.77m E 4620563.63 m N; 37 T 727420.22m E 4620765.29m N; 37 T 727188.34m E 4620558.42m N, in slightly inclined exposition.

Even a visual observation of the object reveals a vegetation group created by a dominance of deciduous and coniferous plants (the dissertation provides photo materials).

The windshield zone created by the Japanese cedar on the upper side of the mentioned object, impacts creation of cenosis. Abundantly developed self-crops near the windshield created a forest of Japanese cedar, which is slowly shifting to downside. Also, growing self-cropped hornbeams occupy territory free from conifers from the lower side. Dominance of those two species create a cenotic structure, confirmed by 3-8 height plants.

As described in the previous group, abandoned tea bushes are covered with the same ferns (*Pteridium tauricum*), blackberry (*Rubus caesius*), giant climbing tearthumb (*Polygonum perfoliatum*), rarely, greenbrier (*Smilax exselsa*) and Japanese honeysuckle (*Lonicera japonica*). Thunbergs (*Polygonum thunbergii*) and two species of cyperus (*Cyperus longus, C. badius*) are represented on the channel sides. There are occasionally grown polster plants created from Chinese silver grass (*Miscanthus sinensis*).

American pokeweed (*Phytolacca americana*) is quite represented, following species are observed in some open places – clover species (*Trifolium diffusum, T. campestre,T. repens*), sour weed (*Rumex acetosella*), sorrel (*Rumex acetosella subsp. acetoselloides*), pasture spikesedge (*Kyllinga gracillima*), Hydrocotyle (*Hydrocotyle ramiflora*), annual bluegrass (*Poa annua*), early blossoming and forest viola (*Viola prionantha, V. reichenbachiana*), Chinese foxtail (*Setaria faberi*), wild strawberry (*Fragaria vesca*), Arenaria (*Arenaria rotundifolia*), apetalous sandwort (*Moehringia trinervia*), scarlet pimpernel (*Anagallis arvensis*), the Asiatic dayflower (*Commelina communis*) and other. Broadleaf plantain (*Plantago major*), Perilla (*Perilla nankinensis*), spurges (*Euphorbia*) and other broadly represented on the roadside (paths). In more open places of the group two species of mosses are presented (*Polytrichum strictum, Calliergonella cuspidata*).

All three vegetation groups recoded in the Chakvi lowland (the Japanese cedar (*Cryptomeria japonica*) dominated; hornbeam and oaks (*Carpinus caucasica, Quercus palustris, Q. falcata*) dominated; hornbeam (*Carpinus caucasica*) and the Japanese cedar dominated (*Cryptomeria japonica*) vegetation groups) were created in the degraded land plots of tea plantations in Chakvi.

There are 71 species recorded in the vegetation group created by the Japanese cedar dominance, in the second group created by a dominance of hornbeam and oaks – 119 species. In all three groups, 60% of total plants number are represented by alien plants. The process of making niche ecological place for existence between the Japanese cedar and deciduous plants are ongoing in each cenosis.

Development of cenosis in the studied groups is greatly influenced by neighbouring developing vegetation groups, including, the Batumi Botanical Garden. The acclimatized species are the ones involved in the development of forming secondary cenosis.

4.2.4. Vegetation groups created by a dominance of black alder *(Alnus glutinosa subs. barbata*), Japanese meadowsweet (*Spiraea japonica L.f.*) and American pokeweed (*Phytolacca americana L.)*

The research object is located on the right side of the Kobuleti-Batumi road, at the border of Sakhalvasho and Green Cape, between GPS coordinates 37 T 726878.37m E 4619586.14m N; 37 T 726948.50m E 4619792.51m N, at 69-79 m above sea level. Construction of the road in this territory has been started in this century followed by cutting down the plants and putting land mass extracted from the tunnel and surrounding area. After that, rapidly growing plants have started settling and creating vegetation group. Thus, we aimed at studying, justifying specific composition of the mentioned vegetation group, which allows us to make projections on future development of cenosis and accordingly,

comparison after certain years.

According to the recordings on the object black alder (*Alnus glutinosa subsp. barbata*), Japanese meadowsweet (*Spiraea japonica*), American pokeweed (*Phytolacca americana*) are dominating species.

There are in total 107 species of plants recorded, where 50 are local and 57 alien (Table 7). Ligneous trees and bushes are represented by 7 local (*Alnus glutinosa subsp. barbata, Acer pseudoplatanus, Cornus australis, Ficus carica, Hedera colchica, Hedera helix, Paliurus spina-christi)* and 11 alien species (*Acacia dealbata, Acer negundo, Ailanthus altissima, Cedrus deodara, Cryptomeria japonica, Juglans ailanthifolia, Paulownia tomentosa, Platanus occidentalis, Quercus palustris, Rosa multiflora, Ulex europaea)*. From bindweed plants, there are also giant climbing tearthumb (*Polygonum perfoliatum),* Colchis and Persian ivy (*Hedera helix, H. colchica*) and greenbrier (*Smilax excelsa*).

Table 7

Composition of the vegetation group created by a dominance black alder (*Alnus glutinosa subsp. barbata*), Japanese meadowsweet (*Spiraea japonica*) and American pokeweed (*Phytolacca americana)*

Species	**Abundance**	**Species**	**Abundance**
Charateristic species of groups (dominant species)			
Alnus glutinosa subsp. barbata (C.A.Mey.) Yalt.	*4*	*Hydrocotyle ramiflora Maxim.*	*2*
Spiraea japonica L.f.	*2*	*Hydrocotyle vulgaris L.*	*2*
Phytolacca americana L.	*2*	*Duchesnea indica (Jacks.) Focke*	*1*
Associated species (companions)			
Acacia dealbata Link	*r*	*Matteuccia struthiopteris (L.) Tod.*	*1*
Acalypha australis L.	*+*	*Mentha aquatica L.*	*+*
Acer negundo L.	*r*	*Mentha pulegium L.*	*+*
Acer pseudoplatanus L.	*r*	*Microstegium imberbe (Ness) Tzvel.*	*+*
Ailanthus altissima (Mill.) Swingle	*r*	*Microstegium japonicum (Miq.) Koidz.*	*+*
Ajuga reptans L.	*+*	*Miscanthus sinensis Andersson*	*+*
Ambrosia artemisiifolia L.	*+*	*Origanum vulgare L.*	*+*
Arthraxon hispidus (Thunb.) Makino	*+*	*Oxalis corniculata L*	*+*
Arum albispathum Steven ex Ledeb. /Arum italicum subsp. albispathum (Prime)	*r*	*Oxalis violacea L.*	*+*
Asplenium scolopendrium L. (Phyllitis scolopendrium (L.) Newman)	*1*	*Paliurus spina-christi Mill.*	*+*
Bidens cernua L.	*+*	*Paulownia tomentosa StDicd*	*r*
Blechnum spicant (L.) Sm	*3*	*Perilla nankinensis Wender. (Plectran-thus scutellarioides (L.) R.B*	*+*
Buddleja davidii Franch	*r*	*Plantago major L*	*+*
Capsella bursa-pastoris (L.) Medik.	*+*	*Platanus occidentalis L*	*r*
Cardamine hirsute L	*+*	*Polygonum perfoliatum L (Persicaria perfoliata (L.)*	*1*
Cardamine parviflora L	*+*	*Polygonum posumbu Buch. -Ham. ex*	*+*

Cedrus deodara (Roxb. ex D.Don) G.Don	*r*	*Polygonum thunbergii Siebold & Zucc.*	*+*
Centaurium erythraea Rafn	*+*	*Potentilla canescens Besser/ Potentilla inclinata Vill.*	*+*
Cichorium intybus L	*+*	*Potentilla reptans L.*	*+*
Cirsium arvense (L.) Scop.	*+*	*Prunella vulgaris L.*	*+*
Cirsium vulgare (Savi) Ten.	*+*	*Pteridium tauricum V.I. Krecz*	*1*
Convolvulus arvensis L	*+*	*Quercus palustris Münchh*	*r*
Commelina communis L	*+*	*Ranunculus muricatus L.*	*+*
Cornus australis C.A.Mey./ Cornus sanguinea subsp. australis (C.A.Mey.) Jáv.	*r*	*Ranunculus sceleratus L.*	*+*
Crassocephalum crepidioides (Benth.) S.Moore	*+*	*Rosa multiflora Thunb.*	*+*
Cryptomeria japonica (Thunb. ex L.f.) D.Don	*+*	*Rubus anatolicus Focke*	*+*
Cynoglossum creticum Mill	*+*	*Rubus hirtus auct./Rubus proiectus A.Beek*	*+*
Cyperus badius Poir.	*+*	*Rumex acetosella subsp. acetoselloides (Balansa) Den Nijs/ R. acetoselloides*	*+*
Cyperus difformis L.	*+*	*Sigesbeckia orientalis L.*	*+*
Cyrtomium falcatum (L. f.) C. Presl	*+*	*Sisymbrium officinale (L.) Scop.*	*+*
Dryopteris remota (A. Braun) Hayek	*1*	*Smilax excelsa L.*	*+*
Eleusine indica (L.) Gaertn	*+*	*Solanum carolinensis L*	*+*
Elsholtzia ciliata (Thunb.) Hyl.	*+*	*Stachys sylvatica L.*	*+*
Equisetum arvense L.	*+*	*Stellaria media (L.) Vill*	*+*
Equisetum palustre L	*+*	*Taraxacum officinale L.*	*+*
Erigeron annuus (L.) Pers	*+*	*Thelypteris limbosperma (All.) H.P.*	*+*
Euphorbia falcata L.	*+*	*Trifolium diffusum Ehrh.*	*+*
Euphorbia stricta L.	*+*	*Trifolium echinatum Bieb.*	*+*
Ficaria popovii A.P. Khokhr.	*+*	*Tussilago farfara L.*	*+*
Ficus carica L.	*+*	*Trifolium pretense L.*	*+*
Galinsoga parviflora Cav.	*+*	*Ulex Europaea*	*r*
Geranium molle L.	*+*	*Urtica dioica L*	*+*
Glechoma hederacea L.	*+*	*Veronica persica Poir*	*+*
Hedera colchica (K.Koch) K.Koch	*+*	*Vicia tetrasperma (L.) Schreb*	*+*
Hedera helix L	*+*	*Viola alba subsp. scotophylla (Jord.) Nyman*	*+*
Hydrangea macrophylla (Thunb.) Ser.	*+*	*Viola prionantha Bunge;*	*+*
Hypericum androsaemum L	*+*	*Viola reichenbachiana Jord. ex Boreau*	*+*
Juglans ailanthifolia Carrière	*r*	*Calliergonella cuspidata (Hedw.) Loeske*	*1*
Juncus bufonius L.	*+*	*Polytrichum strictum Menzies ex Brid.*	*1*
Juncus effuses L.	*+*	*Odontoschisma denudatum (Nees) Dumort.*	*1*
Lysimachia japonica Thunb	*+*		

Phytocenological analysis:

The group is created on red soil. The main cover is not differentiated by the sub-layers. The first

layer of the bosket is dominated by black alder (*Alnus glutinosa subsp. barbata*), height is 8-12 m. there are also few examples of boxelder maple and sycamore maples (*Acer negundo, A. pseudoplatanus*), tree of heaven (*Ailanthus altissima*), silver wattle (*Acacia dealbata*), Himalayan cedar (*Cedrus deodara*). The closure of the main cover is uneven.

Sub-forest (the second layer) is unevenly developed. 1-2 m height dominated bushes - Japanese meadowsweet (*Spiraea japonica*) and American pokeweed (*Phytolacca americana*) are in strong positions. There are few samples of European gorse (*Ulex Europaea).* There are also Jerusalem thorns (*Paliurus spina-christi*) recorded on the roadsides.

The grass cover (the third layer) is well developed in not overshadowed, open places. There are leading indigenous, as well as adventive species. The ground surface is particularly all covered with two species of Hydrocotyle (*Hydrocotyle ramiflora, H. vulgaris*) and mock strawberry (*Duchesnea indica),* there are plenty of polygonums (*Polygonum perfoliatum, P. posumbu, P. thunbergii*). 6 species of ferns are recorded in this vegetation group (*Asplenium scolopendrium, Blechnum spicant, Dryopteris remota, Cyrtomium falcatum, Pteridium tauricum, Thelypteris limbosperma),* which is basically related to high humidity created by black alder coverage.

The phytocenosis edifier (black alder) is actively renewing naturally with the seed and root sprouts. There are many self-crops of the Japanese cedar (*Cryptomeria japonica*), which are giving up positions due to competition with black alder and remains in crushed condition.

5. Current condition of the secondary phytocenosis in the Kakhaberi lowland

5.1. Urbanisation – one of the components of flora structure

The strongly established secondary cenosis, formed or in a stable formation process, was not identified in the Kakhaberi lowland. The most of the territory is covered with agro cenosis.

Following the research purpose, the plants for the cenological recordings were selected from the closed inactive landfill territory in the Kakhaberi lowland. An object with original structure and specificity of forming alien and local plants was selected, where waste has been disposed since 1960s. Currently, this territory in the Kakhaberi lowland is represented by unstable cenosis with ongoing settlement of the plants.

Nowadays, there is no natural flora in the world, which is not under anthropogenic influence. The anthropogenic transformation of the plant cover includes all the territories with any human influence. The global anthropogenic influence forms technogenic ecotypes, with no natural analogies. Urbanization and related urban landscapes, urban cenosis with elements of ruderal flora are examples of such technogenic ecotypes.

Currently, urbanization takes gigantic scale and pace. In the mid XIX only 3% of the world population were living in the cities, while in the mid of XX century this number reached 34%. According to data from 2018, number of people living in the world cities is more than 55% and according to the prognosis, in 2050 it will be 68% (World Urbanization Prospects, 2018).

Urbanization index in Georgia is 53%. Batumi is characterised with the fast urban growth.

From the beginning of XXI century, various constructions, settlement of the new territories have been ongoing in the seaside Ajara followed by construction of the parks, squares, recreational places. For construction of living buildings, shore protection works, infrastructural projects, green places, the construction materials are usually transported from one to another district of the city, the materials are also imported from the foreign countries. Almost all decorative plants, seeds and other planting decorative

materials are imported from abroad, that unintentionally comes with the alien origin, potentially invasive species. All of this adds to import of plants in various forms and species by the plant lovers or the entrepreneurs for decorative or production purposes, that are spread in nature, settle locations, abandoned construction objects, road and water channel sides and so on.

Another subject for discussion is the plants diversity in the Batumi Boulevard with a century-long history and other green places, which are bearing fruits and giving seeds, sometime self-crops as well.

Eventually, all of the above mentioned supports intentional or unintentional spread of alien plants in the city territory, which is accumulated at the Batumi landfill territory at the end, where vegetation with peculiar form and structure is being formed. Thus, we set a goal and studied the vegetation at the inactive, closed landfill surrounding territory.

5.2. Flora analysis in the Batumi landfill

The territory of the closed Batumi landfill is located on the left bank of Chorokhi river, at 1-5 above sea level. The GPS coordinates are 37 T 715784.81m E 4608611.67m N; 37 T 715305.90m E 4609073.63m N; 37 T 715325.29m E 4609397.46m N.

The landfill has been operational since 1960s. The total territory covers up to 20 ha, including, active 10 ha and inactive and closed 10 ha with ongoing vegetation settling process. There is a process of developing the secondary cenosis.

At first, only waste collected in the Batumi territory was disposed in the mentioned locations, but in the recent years, other municipalities of Ajara were also added. All types of waste are disposed there (household, construction, industrial, collected on streets, etc.)

In total, 239 species were recorded within the research, which are united in 59 families of 162 genera. Out of which cryptogams are represented by3 species of horsetail (1.25%) (*Equisetum arvense, E. palustre, E. ramosissimum*), ferns and gymnosperms have not been detected. As for angiosperms, 43 (17.99%) of recorded monocotyledonous species are united in 8 families and 28 genera, while 193 (80.75%) species of dicotyledons cover 51 families and 134 genera (Table 8).

Table 8

Flora of the Batumi landfill – with indication of living form, ecological group and class (the dissertation additionally presents origin and family information)

(Living form: Ph-Phanerophyte, Th-Theropyte, He–Hemicryptophyte, Cr-Cryptophyte, Ch-Chamaephyte; **Class:** Dic-Dicotyledons, Mo-monocotyledons; Sp-Cryptogams; **Ecological group:** R – Ruderal, F – forest plant, P – lowland (seaside, sandy ground, etc.) plant, G – meadow, shrubbery and rock plant, H – high humidity territory or humid meadow plant, M – mountain plant).

Species	Class	Ec. Gr.	Liv. form	Species	Class	Ec. Gr.	Liv. form
Abutilon theophrasti Medik.	Dic	R	Th	*Lotus tenuis* Waldst. & Kit.	Dic	P	He
Acacia dealbata Link.	Dic	F	Ph	*Ludwigia palustris* (L.) Elliott	Dic	R	Th
Acalypha australis L.	Dic	R	Th	*Luzula forsteri* (Sm.) DC.	Mo	G	He
Acer negundo L.	Dic	R	Ph	*Lycopus europaeus* L.	Dic	H	He
Ailanthus altissima (Mill.) Swingle	Dic	P	Ph	*Lysimachia japonica* Thunb.	Dic	R	He
Aira elegans Willd	Mo	F	Th	*Lythrum salicaria* L.	Dic	H	Cr

Ajuga reptans L.	Dic	P	He	*Malva neglecta* Wallr.	Dic	R	He
Alnus glutinosa subsp. barbata (C.A.Mey.) Yalt*., (Alnus barbata* C.A.Mey)	Dic	F	Ph	*Malva ambiqua Guss.*	Dic	R	He
Alocasia macrorrhizos (L.) G.Don.	Mo	G	Cr	*Marrubium vulgare* L.	Dic	R	Ch
Amaranthus albus L.	Dic	R	Th	*Melilotus albus* Medik.	Dic	P	Th
Amaranthus caudatus L.	Dic	R	Th	*Melilotus officinalis* (L) Dsr.	Dic	P	Th
Amaranthus deflexus L.	Dic	R	Th	*Mentha aquatica* L.	Dic	H	He
Amaranthus lividus L.	Dic	R	Th	*Mentha pulegium* L.	Dic	H	He
Amaranthus retroflexus L.	Dic	R	Th	*Microstegium imberbe* (Ness) Zvel	Mo	R	Th
Ambrosia artemisiifolia L.	Dic	R	Th	*Microstegium japonicum* (Miq.) Koidz	Mo	R	He
Ammi visnaga L.	Dic	F	Th	*Microstegium vimineum* (Trin.) A.Camus	Mo	R	Th
Amorpha fruticosa L.	Dic	F	Ph	*Mirabilis jalapa* L.	Dic	R	Cr
Angelica sylvestris L.	Dic	F	Cr	*Miscanthus sinensis* Andersson	Mo	R	Cr
Anthemis cotula L.	Dic	R	Th	*Morus alba* L.	Dic	G	Ph
Arabis nova Vill. *(Arabis auriculata* Lam.*)*	Dic	R	Th	*Myosotis palustris* (L.) Nathh. */Myosotis scorpioides* L.	Dic	H	He
Arctium lappa L.	Dic	R	Th	*Oenothera bienis* L.	Dic	R	He
Artemisia absinthium L.	Dic	R	He	*Oplismenus burmanni (*Retz.) P.Beauv.	Mo	R	He
Artemisia annua L.	Dic	R	Th	*Oplismenus undulatifolius* (Ard.) Beauv.	Mo	F	He
Artemisia vulgaris L.	Dic	R	He	*Oxalis corniculata* L.	Dic	R	Th
*Arthraxon hispidus (*Thunb.*)* Mak.	Mo	R	Th	*Oxalis violacea* L.	Dic	R	Cr
Atriplex tatarica L.	Dic	R	Th	*Parentucellia latifolia* Caruel.	Dic	P	Th
Bidens cernua L.	Dic	R	Th	*Parthenocissus quinquefolia* (L.) Planch.	Dic	R	Ph
Bifora radians Bieb.	Dic	R	Th	*Paspalum distichum* L. *(Paspalum paspalodes* (Michx.)	Mo	R	Cr
*Bothriochloa ischaemum (*L.) Keng	Mo	F	He	*Paspalum thunbergii* Kunth ex Steud.	Mo	R	Cr
Buddleja davidii Franch	Dic	R	Ph	*Perila nankinensis* (Lour.) Decne*/ Plectranthus scutellarioides* (L.)	Dic	R	Th
Calystegia sepium (L.) R. Br.	Dic	H	He	*Persicaria hydropiper* (L.) Delarbre *(Polygonum*	Dic	H	Th

				hydropiper L.)			
Calystegia soldanella (L.) R. Br.	Dic	H	He	*Persicaria maculosa* Gray *(Polygonum persicaria* L.)	Dic	H	Th
Capsella bursapastoris (L.) Medik.	Dic	R	He	*Persicaria orientalis* (L.) Spach. *(Polygonum orientale* L.)	Dic	R	Th
Cardamine hirsuta L.	Dic	R	Th	*Persicaria perfoliata* (L.) *(Polygonum perfoliatum* L.)	Dic	R	Th
Cardamine parviflora L.	Dic	R	Th	*Physalis ixocarpa* Brot. ex Hornem.	Dic	P	Th
Cardamine quinquefolia (M.Bieb.) Schmalh.*(Dentaria quinquefolia* M.Bieb.*)*	Dic	P	Th	*Phytolacca americana* L.	Dic	R	Cr
Carex divulsa Stokes.	Mo	P	Ch	*Plantago major* L.	Dic	R	He
Carex pendula Huds.	Mo	H	Ch	*Platanus occidentalis* L.	Dic	F	Ph
Carum carvi L.	Dic	G	He	*Poa annua* L.	Mo	H	Th
Centaurea oxylepis (Wimm. & Grab.) Hayek	Dic	P	Th	*Poa compressa* L.	Mo	P	He
Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch	Dic	P	Th	*Poa pratensis* L.	Mo	G	He
Cerastium glomeratum Thuill.	Dic	P	He	*Polycarpon tetraphyllum* (L.)	Dic	P	Th
Chelidonium majus L.	Dic	R	He	*Polygonum aviculare* L.	Dic	R	Th
Chenopodium album L.	Dic	R	Th	*Polygonum minus* Huds.	Dic	R	Th
Chenopodium urbicum L.	Dic	R	Th	*Polygonum posumbu* Buch. - Ham. ex D. Don.	Dic	R	Th
Cichorium intybus L.	Dic	PM	He	*Polygonum thunbergii* Siebold & Zucc.	Dic	H	Th
Cirsium arvense (L.) Scop.	Dic	R	He	*Portulaca oleracea* L.	Dic	R	Th
*Cirsium vulgare (*Savi) Ten.	Dic	R	He	*Prunella vulgaris* L.	Dic	F	Th
Cleome houtteana Schltdl *(Cleome hassleriana* Chodat*)*	Dic	P	Th	*Pycreus flavescens* (L.) Beauv. ex Rchb.	Mo	H	Th
Commelina communis L	Mo	P R	Th	*Ranunculus muricatus* L.	Dic	R	Th
Convolvulus arvensis L	Dic	R	Cr	*Ranunculus sceleratus* L.	Dic	H	He
Coreopsis tinctoria Nutt.	Dic	P	Th	*Rhus javanica* L*/ Brucea javanica* (L.) Merr.	Dic	R	Ph
Cornus sanguinea subsp. australis (C.A.Mey) Jáv. *(Cornus australis)*	Dic	F	Ph	*Robinia pseudoacacia* L.	Dic	F	Ph
Crassocephalum crepidioides (Benth.) S.Moore	Dic	R	Th	*Rosa multiflora* Thunb.	Dic	P	Ph
Crepis setosa Haller f.	Dic	P	Th	*Rubus anatolicus* Focke.	Dic	F	Ph
Cuscuta australis R.Br.	Dic	R	Th	*Rubus caesius* L.	Dic	F	Ph

Cynoglossum creticum Mill.	Dic	R	He	*Rubus proiectus* A.Beek/ *Rubus hirtus auct.*	Dic	F	Ph
Cyperus badius Poir.	Mo	H	Cr	*Rubus serpens* Weihe ex Lej. & Courtois	Dic	F	Ph
Cyperus esculentus L.	Mo	H	Cr	*Rudbeckia hirta* L.	Dic	R	He
Cyperus longus L.	Mo	H	Cr	*Rumex acetosella* L.	Dic	G	He
Datura stramonium L.	Dic	R	Th	*Rumex acetosella subsp. acetoselloides (Balansa)* Den Nijs/ *R. acetoselloides* Balansa	Dic	R	He
Daucus carota L.	Dic	P	Cr	*Rumex pulcher* L.	Dic	R	He
Digitaria violascens Link.	Mo	R	Th	*Salix babylonica L.*	Dic	H	Ph
Duchesnea indica (Jacks.) Focke	Dic	P	He	*Salix caprea* L.	Dic	H	Ph
Dysphania ambrosioides (L.) Mosyakin & Clemants *(Chenopodium ambrosioides* L.*)*	Dic	R	He	*Sambucus ebulus* L.	Dic	R	Ch
Elaeagnus rhamnoides (L.) A. Nelson.(*Hippophae rhamnoides)*	Dic	G	Ph	*Sambucus nigra* L.	Dic	F	Ph
Eleusine indica (L.) Gaertn.	Mo	R	Th	*Saxifraga stolonifera* Curtis.	Dic	P	Cr
Elsholtzia ciliata (Thunb.) Hyl.	Dic	R	Th	*Scirpus sylvaticus* L.	Mo	FH	Cr
Epilobium palustre L.	Dic	H	He	*Scrophularia nodosa* L.	Dic	H	He
Equisetum arvense L.	sp	H	Cr	*Senecio sylvaticus* L.	Dic	P	Th
Equisetum palustre L.	sp	H	Cr	*Senecio vernalis* Waldst. & Kit. */Senecio leucanthemifolius subsp. vernalis (*Waldst. & Kit.)	Dic	R	Th
Equisetum ramosissimum Desf.	sp	H	Cr	*Senecio vulgaris* L.	Dic	R	Th
Erigeron annuus (L.) Pers.	Dic	P	Th	*Setaria faberi* R.A.W. Herrm	Mo	R	Th
Erigeron bonariensis L.	Dic	R	He	*Setaria intermedia* Roem. et Schult.	Mo	R	Th
Erigeron Canadensis L.	Dic	R	Th	*Sherardia arvensis L.*	Dic	R	Th
*Eriobotrya japonica (*Thunb.) Lindl.	Dic	P	Ph	*Sigesbeckia orientalis* L.	Dic	R	Th
Euphorbia falcata L.	Dic	R	Th	*Sisymbrium officinale* (L.) Scop.	Dic	R	Th
Euphorbia peplus L.	Dic	R	Th	*Sisyrinchium septentrio-nale* E.P.Bicknell	Mo	R	Th
Euphorbia stricta L.	Dic	R	Th	*Smilax excelsa* L.	Mo	F	Ph
Fallopia dumetorum (L.) Holub *(Polygonum dumetorum* L.*)*	Dic	R	Th	*Solanum carolinense* L.	Dic	R	Ch
Ficus carica L.	Dic	S	Ph	*Solanum decipiens* Opiz.	Dic	R	Th
Filago arvensis L.	Dic	M	Th	*Solanum luteum* Mill.	Dic	R	Th

Filago gallica L.	Dic	P	Th	*Solanum nigrum* L./*Solanum americanum* Mill.	Dic	R	Th
Fragaria vesca L.	Dic	G	He	*Solanum pseudocapsicum* L.	Dic	R	Ph
Frangula alnus Mill.	Dic	F	Ph	*Solidago canadensis L.*	Dic	R	He
Galinsoga ciliata (Raf.)/ G. *quadriradiata* Ruiz & Pav	Dic	R	Th	*Sorghum halepense* (L.) pers.	Mo	R	He
Galinsoga parviflora Cav.	Dic	R	Th	*Sparganium erectum subsp. neglectum* (Beeby) K.Richt.	Mo	H	Cr
Galium palustre L.	Dic	R	Th	*Spiraea japonica* L.*f.*	Dic	R	Ph
Galium spurium L.	Dic	R	Th	*Sporobolus fertilis* (Steud.) Clayton	Mo	R	He
Galium tricornutum Dandy.	Dic	R	Th	*Stachys annua* L.	Dic	R	Th
Geranium dissectum L.	Dic	G	Th	*Stellaria graminea* L.	Dic	P	He
Geranium sibiricum L.	Dic	G	He	*Stellaria holostea* L.	Dic	P	He
Glechoma hederacea L.	Dic	P	Ph	*Stellaria media* (L.) Vill.	Dic	H	Th
Gleditschia triacanthos L.	Dic	F	Ph	*Symphyotrichum gramini-folium* (Spreng.) G.L. Nesom *(Conyzanthus graminifolius (*Spreng.) Tamamsch.	Dic	R	He
Hibiscus syriacus L.	Dic	R	Ph	*Tagetes minuta* L.	Dic	R	Th
Hydrocotyle ramiflora Maxim.	Dic	H	Ch	*Taraxacum officinale* Wigg.	Dic	G	Cr
Hydrocotyle vulgaris L.	Dic	H	Ch	*Torilis arvensis (*Huds.) Link.	Dic	R	Th
Hypericum androsaemum L.	Dic	F	Ch	*Torilis japonica* (Houtt.) DC.	Dic	R	He
Hypochaeris radiata Falk.	Dic	P	He	*Tradescantia fluminensis* Vell.	Mo	R	He
Impatiens balsamina L.	Dic	R	Th	*Tradescantia virginiana* L.	Mo	R	He
Juglans ailanthifolia Carrière	Dic	F	Ph	*Trifolium campestre* Schreb.	Dic	P	Th
Juglans cordiformis Wangenth. */Carya cordiformis* K.Koch.	Dic	F	Ph	*Trifolium diffusum* Ehrh.	Dic	P	Th
Juncus bufonius L.	Mo	H	Th	*Trifolium echinatum* Bieb.	Dic	P	Th
Juncus effuses L.	Mo	H	Cr	*Trifolium fragiferum* L.	Dic	P	Th
Juncus tenuis Willd.	Mo	H	Cr	*Trifolium micranthum* Viv.	Dic	P	Th
Kummerowia striata (Thunb.) *(Lespedeza striata* (Thunb.)	Dic	R	Th	*Typha angustifolia* L.	Mo	H	Cr
Kyllinga gracillima Miq.	Mo	H	He	*Typha latifolia* L.	Mo	H	Cr
Lactuca serriola L.	Dic	R	He	*Urtica dioica* L.	Dic	R	He
Lamium purpureum L.	Dic	R	He	*Verbascum blattaria* L.	Dic	R	Ch
Laphangium affine (D.Don) *Tzvelev (Gnaphalium affine* D.	Dic	R	He	*Verbena brasiliensis* Vell.	Dic	P	Ch
Laphangium luteoalbum (L.) *Tzvelev. (Gnaphalium*	Dic	R	He	*Verbena officinalis* L.	Dic	R	Ch

luteoalbum L.)							
Lathyrus aphaca L.	Dic	R	Th	*Veronica persica* Poir.	Dic	R	Th
Lathyrus hirsutus L.	Dic	S	Th	*Vicia lathyroides* L.	Dic	R	Th
Leontodon hispidus subsp. hastilis (L.) Corb.	Dic	S	Th	*Vicia sativa subsp. cordata* (Hoppe) Asch. & Graebn.	Dic	G	Th
Lepidium campestre (L.) R. BR.	Dic	P	He	*Viola prionantha* Bunge.	Dic	R	Th
Lepidium coronopus (L.) *(Coronopus squamatus* (Forssk.)	Dic	R	He	*Viola reichenbachiana* Jord. ex Boreau	Dic	F	Th
Lespedeza bicolor Turcz.	Dic	R	Ch	*Xanthium orientale subsp. californicum (*Greene) Greuter / *Xanthium californicum* Greene.	Dic	R	Th
Lolium perenne L.	Mo	R	Ch	*Xanthium spinosum* L.	Dic	R	Th
Lolium rigidum Gaudin.	Mo	R	Th	*Xanthium strumarium* L.	Dic	R	Th
Lonicera japonica Thunb.	Dic	R	Ph				

Out of presented 59 families, 5 and more species represent 11 families, where 62.75% of species (150 species) are united. Those families are: Aster (*Compositae)* – 40 species (17.57%), grasses *(Poaceae)* – 22 species (9.20%), legumes (*Leguminosae)* - 18 species (7.53%) (Table 9).

Table 9

Families distinguished with the species abundance

#	Family	Number of species	Species in %%
1	Asters/*Compositae*	40	16.73
2	Grasses /*Poaceae*	22	9.20
3	Legumes /*Leguminosae*	18	7.53
4	Mints /*Lamiaceae*	13	5.43
5	Buckwheats /*Polygonaceae*	12	5.02
6	Roses/*Rosaceae*	9	3.76
7	Amaranthes /*Amaranthaceae*	9	3.76
8	Sedges /*Cyperaceae*	8	3.34
9	Nightshades /*Solanaceae*	7	2.92
10	Crucifers /*Brassicaceae*	7	2.92
11	Carnations /*Caryophyllaceae*	5	2.09
	Others	150	62.75%

The rest 48 families unite 87 species, those are: *Convolvulaceae, Euphorbiaceae, Juncaceae, Malvaceae, Rubiaceae* 4-4 species each; *Apiaceae, Commelinaceae, Equisetaceae, Onagraceae, Scrophulariaceae, Typhaceae* 3-3 species each; *Adoxaceae, Araliaceae, Boraginaceae, Gentianaceae, Juglandaceae, Moraceae, Plantaginaceae, Ranunculaceae, Salicaceae, Simaroubaceae* 2-2 species each.

Araceae, Balsaminaceae, Betulaceae, Caprifoliaceae, Cleomaceae, Cornaceae, Elaeagnaceae, Geraniaceae, Hypericaceae, Iridaceae, Lythraceae, Nyctaginaceae, Orobanchaceae, Papaveraceae, Phytolaccaceae, Platanaceae, Portulacaceae, Primulaceae, Sapindaceae, Saxifragaceae, Smilacaceae, Urticaceae, Vitaceae 1-1 specie each.

The following recorded plants are distinguished with an abundance genera: amaranths (Amaranthus*),* nightshade *(Solanum),* clover *(Trifolium)* - 5-5 species each; knotweed (*Persicaria), Polygonum,* blackberry *(Rubus)* 4-4 species each; wormwood (*Artemisia),* cyperus *(Cyperus),* horsetail *(Equisetum),* erigeron *(Erigero),* spurge *(Euphorbia),* bedstraw *(Galium),* soft rush *(Juncus),* mint *(Mentha),* annual bluegrass *(Poa),* sour weed *(Rumex),* groundsel *(Senecio),* starwort (*Stellaria), xanthium (Xanthium)* - 3-3 species each and so on.

From the species recorded in the research object 80 (33.7%) are local, 159 (66.53%) are of alien origin, out of which 46 are East Asian, 36 European (including, 33 Atlantic European species), 1 Australian, 12 South American, 29 North American, 35 Mediterranean. Positions of the East Asian species are resulted by several conditions, out of which – the same climate conditions, high humidity, positive temperature indicators during a whole year, ground containing organic and non-organic substances created from bio mass decomposition are worth mentioning. The Mediterranean and European species come as the second by the number of the species, which is basically conditioned by the phyto geographical structure of Ajarian flora (Fig. 4).

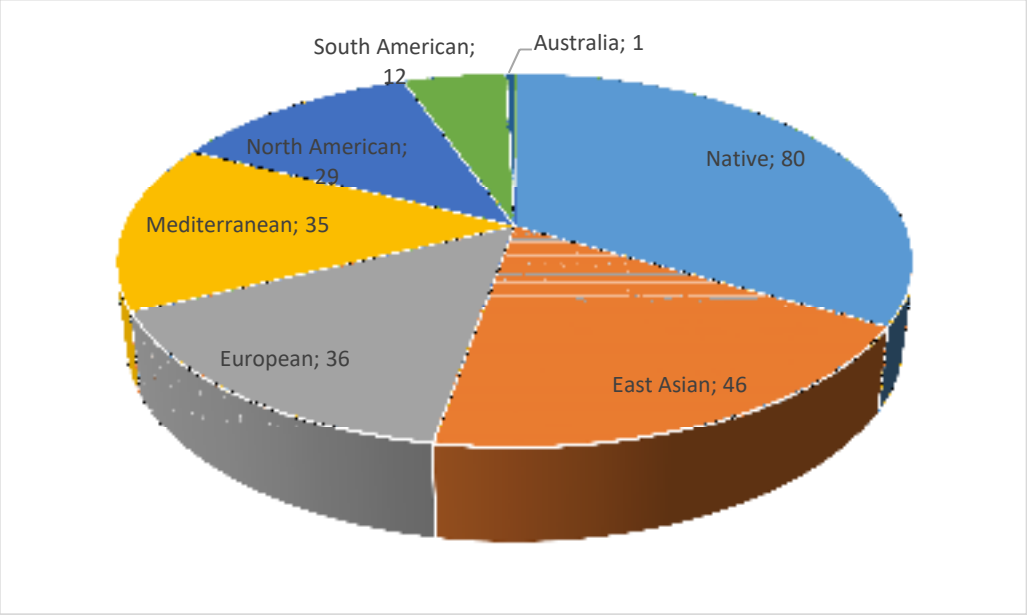

Fig. 4. Spectre of species according to origin recorded in the Batumi landfill

According to the research on living forms in the Batumi landfill flora, based on the Raunkiaer classification, therophytes prevail represented by108 (44.76%) species of annual grass species, which is followed by hemicryptophytes with 60 species (25.10%) uniting mainly biennial and perennial grass plants (Table 10). The dominance of therophytes and hemicryptophytes complies with the specificity of the ruderal flora composition.

Table 10

Living forms spectre in the Batumi landfill flora

#	Living form	Number of species	Species in %%
1	Theropyte -Th	108	45.18
2	Hemicryptophyte -He	60	25.10
3	Phanerophyte -Ph	33	14.22
4	Cryptophyte -Cr	25	10.47
5	Chamaephyte -Ch	13	5.03
	Total	239	100

Phanerophytes are quite diverse, out of 33 species 14 are local *(Alnus glutinosa subsp. barbata* (C.A.Mey.) Yalt*., Cornus sanguinea subsp. australis* (C.A.Mey.) Jáv*., Frangula alnus* Mill*., Elaeagnus rhamnoides* (L.) A.Nelson., *Ficus carica* L*., Glechoma hederacea* L*., Rubus anatolicus* Focke., *Rubus caesius* L., *Rubus proiectus* A.Beek*., Rubus serpens* Weihe ex Lej. & Courtois*., Salix babylonica* L., *Salix caprea* L., *Sambucus nigra* L., *Smilax excelsa* L*.)* and 19 alien origin *(Acacia dealbata* Link*, Acer negundo* L*., Ailanthus altissima* (Mill.) Swingle, *Amorpha fruticosa* L., *Buddleja davidii* Franch., *Eriobotrya japonica* (Thunb.) Lindl., *Hibiscus syriacus* L*. Rhus javanica* (L.) Merr. *Gleditschia triacanthos* L., *Lonicera japonica* Thunb*., Juglans ailanthifolia* Carriere, *Carya cordiformis* (Wangenh.) K.Koch., *Morus alba* L*., Parthenocissus quinquefolia* (L.) Planch*., Platanus occidentalis* L*., Robinia pseudoacacia* L., *Rosa multiflora* Thunb., *Solanum pseudocapsicum* L., *Spiraea japonica* L.f.).

On the mentioned location, phanerophytes blossom, bear-fruit, give self-crops, are characterised with full development cycle, they are settling and even dominating some of the cenosis. As for chamaephytes and hemicryptophytes, nature of living forms is determined by the local climate conditions, revealed in modified forms of phenophases and plant vegetation. For example, Brazilian verbena is an annual plant according to the literature data, however, in our climate conditions, the plant is evergreen during winter-summer time, it casually blossoms and gives bears fruit and seeds the same year. It does not go to resting phase, develops renewed buds below the stems after unfavourable climate conditions.

Among species recorded in the Batumi inactive landfill we came across the species characterized for various habitats – forest, meadow, decorative, humid places, low zone and mountain and high mountainous zones as well, local and alien species, etc. Out of 239 species, 91 are representatives of ruderal flora.

There are also self-crops of maize, beans, tomato, pumpkin, watermelon, melon, peach, apple, pear, wild plum, cherry and other plants. Such a diversity of the plants recorded in the Batumi landfill is a result of anthropogenic factors.

Household and construction waste, solid waste from parks, greening places of Batumi and other municipalities and the Boulevard territory brought to the Batumi landfill supports diversity of species and living forms. Vagrant and nesting birds and domestic animals contribute to the spread of vegetation.

6. Alien new species in the Ajara florist region

As mentioned in the beginning, invasion and settlement of alien origin species to the seaside Ajara have been ongoing since ancient times to date. Within the research carried, we have recorded 3 alien

species unfamiliar to Ajara flora – South American verbena (*Verbena brasiliensis*), European lobelia (*Lobelia urens*), and also American origin, outside culture (naturalised) purple passionflower *(Passiflora incarnate).*

***Verbena brasiliensis Vell*. Brazilian verbena –** Brazilian verbena was recorded for the first time in 1950s in Sokhumi, Abkhazia. Philip Verlove saw the herbarium of this plant in the herbarium of the Belgium botanical garden. Originally, the plant was taken by Vladimer Wasaki from Sokhumi in 1979 as *Verbena hastata* plant. Verlove researched a plant sample taken by Wasaki, which occurred to be *Verbena brasiliensis.*

Brazilian verbena is widely spread in seaside Ajara on the roadsides, along railway, ruderal locations, channel and river blanks, abandoned construction polygons. Brazilian verbena is a perennial, upright, branching, 50-180-210 cm height plant. Stems are quadrangular. Leaf hooked, elliptic-lanceted, with sharpened tip, narrowed bottom, with distinguished vascular tissues on the both sides. Uneven dentate edges. Bottom leaves are sometimes transparent. Flowers are many in blue-purple. The plant starts blossoming in April-May until November. The plant develops up to 90 000 seeds in the second year of development (Picture 1).

Pict. 1. ***Verbena brasiliensis* Vell**

***Lobelia urens* L**. heath lobelia – is a new plant for Georgian flora. It is of European origin, perennial, root running grass plant from bellflower (*Campanulaceae*) genus. Bending on the roots determine number of sprouts usually developing in early spring. Sprouts are composed of 5-15 cm long edged leaves – egg-like on the bottom and elongated at the end. 10-100 cm height upright sprouts are developed on the roots. Stem may be simple or branching with flowering sprouts. Flowers are hermaphrodite, zygomorphous, 1.5 cm long, pentapetalous wreath, entomophile, sometimes self-fertilized. Wreath petals are 10-15 cm long in bright purple. Filaments are free, while antheridium is attached to the wreath. Pollen sacks are black and incanous. Pistil is bilocular with multiple ovules. Ovary produces up to

200 light brown coloured 1 mm less in size seeds. Seed maturing and scattering go in parallel with plant blossoming. It starts blossoming at the end of May – beginning of June and lasts until the end of October, and in some samples blossoming is detected in November as well. In the late autumn, after blossoming the above-ground parts die (Picture 2).

Passiflora incarnata L. purple passion flower – American origin, perennial grass plant from the passion flowers (Passifloraceae) family Picture 3. In 1980s and 90s this plant was under research in Kobuleti in the Medicinal Herbs Research Institute. Currently, this is widely spread on the surrounding of Kobuleti bypass road. It is vining or upright, glossing plant with tendril stem. Leaf is three lobed; flower is in bluish-purple colour. It starts blossoming from the end of May. Fruit is juicy (Pict.3).

Pict. 2. *Lobelia urens* L.

Pict.3. ***Passiflora incarnata*** L

Conclusions

1. According to the literature sources, invasion of alien species and successional events have started in ancient times, which is still ongoing as confirmed by a spread dynamics of the plants, our records and research.

2. At the end of XIX century, Ajara flora recorded 134 alien species, in the twenties of the twentieth century – 168, in the forties – 281, in the 70s – 350, in the 90s – 439, at the beginning of XXI century – up to 450. Currently, the total number amounts up to 500 species.

3. In parallel with the adventive species, spread of alien species was particularly influenced by the Batumi Botanical Garden, parks, different gardens-parks, nurseries, plant species brought in by the private summer visitors and so on.

4. Our study about spreading and biological characteristics of ligneous plants and plants with ligneous stems in the seaside Ajara revealed 68 naturalized species of 48 genera of 31 families, which grow, blossom, bear-fruit, gives self-crops and root sprouts quite well and eventually settles and participates in creation of cenosis.

a) The following families are distinguished by a diversity of species: legume (*Leguminosae*) – 9 species, beech (*Fagaceae*) - 6 species, grasses (*Poaceae*) - presented by 5 species, rose and olive families *(Rosaceae & Oleaceae)* with 4 species each.

b) Oak (*Quercus* L.) is a rich family presented by 6 species, eucalyptus, privet and pseudosasa *(Euiccalyptus* L'Hér*., Ligustrum* L*, Pseudosasa* Makino ex Nakai) with 3-3 species each. Acacia, aleurites, cinnamomum, oleaster, walnut, tulip, pine, bamboo and meadowsweets (*Acacia* Martius*, Aleurites J*.R.Forst. & G.Forst*, Cinamomum* Schaeff*, Eleagnus* L*, Juglans* L*, Liriodendron* L*., Phyllostachys* Siebold & Zucc*., Pinus* L*., Spiraea* L.) – with 2 species each, while the rest genera are presented with one specie each.

5. The majority of the alien species have the East Asian (47 species) elements and represent 68% of the naturalised ligneous plants. 13 species are North American, 5 species – Australian, 2 – of Mediterranean origin, 1 – Himalayan.

6. According to the simple classification of living forms, tree plants are presented with 41 species (60.3%), bushes – 17 species (25%), liana – 4 species (5.9%), palm – 1 specie (1.4%) and perennial ligneous stem grass (bamboo) – 5 species. 94% or 64 species are deciduous, and 6% or 4 species are coniferous. 3 species (4%) are evergreen conifers, 29 species (43%) are evergreen deciduous, 34 species (50%) are deciduous, 1 specie (2%) is deciduous coniferous. 1 specie (1%) is semi evergreen.

7. Based on the research vegetation and spreading characteristics of widespread ligneous alien plants, 4 groups were outlined:

7.1 Species are abundantly reproduced in vegetative and generational way, expelling local, as well as, alien origin plants and creating particularly clear groupings uniting 7 species (bamboos, amorpha and

pueraria *Amorpha fruticosa* L.*, Phyllostachys edulis* (Carrière) J.Houz*, Phyllostachys bambusoides Siebold & Zucc., Pseudosasa japonica (StDicd.) Makino., Pseudosasa hindsii (Munro) C.D.Chu & C.S.Chao., Pseudosasa humilis (Mitford) T.Q.Nguyen., Pueraria montana var. lobata (Willd.) Sanjappa & Pradeep,);*

7.2. Species are reproduced abundantly creating cenotic links with local and alien origin plants. It unites16 species: (*Acacia dealbata* Link*., Acacia melanoxylon* R.Br*., Acer negundo* L*., Ailanthus altissima* (Mill.) Swingle*., Albizia julibrissin* Durazz*., Aleurites cordata* and others);

7.3 The species are reproduced around maternal plant, sometimes quite abundantly, they create cenotic links with other species and are spread far from cultivation locations. There are 30 species in this group (walnut, eucalyptus, ligustrum (*Juglans cordiformis* Wangenth. */Carya cordiformis (*Wangenth) K.Koch*., Catalpa speciosa* (Warder ex Barney) Warder ex Engelm*., Cedrus deodara (*Roxb. ex D.Don*)* G.Don*., Daphniphyllum macropodum* Miq*., Elaeagnus umbellata* Thunb*., Elaeagnus pungens* Thunb*., Eriobotrya japonica (*Thunb.) Lindl*.,* and others);

7.4. Species are reproduced abundantly only around maternal plant, without leaving cultivation places and creating cenosis. The group unites 15 species (*Akebia quinata* (Houtt.) Decne*., Berberis levis* Franch*., Cupressus lusitanica* Mill*., Cudrania tricuspidata/Maclura tricuspidata* Carrière*., Deutzia scabra* Thunb*., Hydrangea macrophylla* (Thunb.) Ser*., Laurus nobilis* L*., Quercus acuta* Thunb*., Fatsia japonica* (Thunb.) Decne. & Planch*. Quercus glauca* and others).

8. Eleven vegetation groups (formation) were selected, distinguished and studied in the secondary cenosis, based on the recording and researched carried in the seaside Ajara lowland and hillocks. In the Kobuleti lowland 6 were recorded:

- Vegetation group with a dominance of the Japanese cedar (*Cryptomeria japonica*);
- Vegetation group with a dominance of eucalyptus (*Eucalyptus viminalis, E. Globulus, E. cinerea*);
- Vegetation group with a dominance of false camphor tree (*Cinnamomum glanduliferum*) and Japanese cedar (*Cryptomeria japonica*);
- Vegetation group with a dominance of Japanese timber bamboo (*Phyllostachys bambusoides*);
- Vegetation group with a dominance of the moso bamboo (*Phyllostachys edulis)*;
- Vegetation group with a dominance of bamboo-leaf oak (*Quercus myrsinifolia*), black alder (*Alnus glutinosa subsp. barbata*) and Japanese cedar (*Cryptomeria japonica)*.

Four groups (formations) were recorded in the Chakvi lowland:

- Vegetation group with a dominance of the Japanese cedar (*Cryptomeria japonica*);
- Vegetation group with a dominance of hornbeam and oaks (*Carpinus caucasica, Quercus palustris, Quercus falcata*);
- Vegetation group with a dominance of hornbeam and the Japanese cedar (*Carpinus caucasica, Cryptomeria japonica*);
- Vegetation group with a dominance of black alder, Japanese meadowsweet and American pokeweed (*Alnus glutinosa subs barbata, Spiraea japonica, Phytolacca americana*);

– Species composition in the inactive, closed landfill was recorded in the Kakhaberi lowland.

9. There are 65 species in the vegetation group created with a dominance of Japanese cedar (*Cryptomeria japonica*), where 33 are local and 32 alien origin, including, ligneous plants presented by 15 species. In the Chakvi lowland, in total 71 species were recorded, 30 local and 41 alien origin, including, 14 ligneous species. Composition of the grass plants are charactersied with more or less similarity.

10. The vegetation group created with a dominance of eucalyptus **(***Eucalyptus viminalis, E. globulus, E. cinerea***)** unites 90 species, where 36 are local and 54 of alien origin, including, ligneous plants presented by 17 species, the rest 73 are grass plants. Abundance of grass and other species is conditioned by phyllotaxy of eucalyptus.

11. Vegetation group - 1) Japanese cedar (*Cryptomeria japonica*) dominant, 2) eucalyptus (*Eucalyptus viminalis, E. globulus, E. cinerea*) dominant, 3) Vegetation group with a dominance of false camphor tree (*Cinnamomum glanduliferum*) and Japanese cedar (*Cryptomeria japonica*) have on common

characteristic in terms of dominance of alien species. Although, local species were cut down and plantations of alien origin species were created in the recorded objects, there are still indigenous ligneous species – hazel (*Corylus avellana*), alder buckthorn (*Frangula alnus*), Caucasian whortleberry (*Vaccinium arctostaphylos*), greenbrier (*Smilax excelsa*), Strandzha oak (*Quercus hartwissiana*), European hornbeam (*Carpinus betulus*), sweet chestnut (*Castanea sativa*), Persian ivy (*Hedera colchica*).

12. Vegetation groups created with a dominance of Japanese timber bamboo (*Phyllostachys bambusoides)* and the moso bamboo (*Phyllostachys edulis*) are characterised with the least specie composition, which is basically related to ability for good self-renewal of bamboos. Bamboos chase out alien, as well as, local species.

13. In comparison to other, in the vegetation groups selected in the Kobuleti lowland, nearby Choloki river (bamboo-leaf oak (*Quercus myrsinifolia*), black alder (*Alnus glutinosa*) and Japanese cedar (*Cryptomeria japonica),* there are 4 species of mosses (*Calliergonella cuspidata, Odontoschisma denudatum, Fissidens sp., Polytrichum strictum*), 4 species of ferns (*Osmunda regalis, Pteridium tauricum, Pteris cretica, Thelypteris limbosperma,*) and 2 species of horsetails (*Equisetum palustre, E. arvense*), characterised for wetland habitat.

14. In the vegetation group created with a dominance of hornbeam *(Carpinus caucasica)* and oaks *(Quercus palustris)*, there are in total 119 species recorded, 48 local and 71 alien origin, the ligneous plants are represented 10 local and 16 alien species. Compositional abundance and diversity of ligneous plants in this vegetation group is probably caused by neighbouring different vegetation groups, including, species invading from the Batumi Botanical Garden with significant role in cenosis (structural) in some of them.

15. Vegetation group created with a dominance of black alder (*Alnus glutinosa subsp. barbata*), Japanese meadowsweet (*Spiraea japonica*) and American pokeweed (*Phytolacca americana*) counts 107 species, where 50 are local and 57 alien origin. Ligneous tree and bushes are represented by 7 local and 11 alien species.

16. In total, 239 species were recorded within the research carried in the Batumi landfill, which are united in 59 families of 162 genera. Out of which cryptogams are represented by 3 species of horsetail (1.25%) (*Equisetum arvense, E. palustre, E. ramosissimum*), ferns and gymnosperms have not been detected. As for angiosperms, 43 (17.99%) of recorded monocotyledonous species are united in 8 families and 28 genera, while 193 (80.75%) species of dicotyledons cover 51 families and 134 genera (Table 8).

17. Out of 59 families presented in the landfill, 5 and more species represent 11 families, where 63.20% of species (151 species) are united. Those families are: Aster/*Compositae* – 40 species (17.57%), grasses/*Poaceae* (22 species (9.20%)), legumes/*Leguminosae* - 18 species (7.53%). 86 species are united in the rest 48 families.

18. The following recorded genera are distinguished with the species abundance in the landfill flora: amaranths/*Amaranthus,* nightshade/*Solanum,* clover/*Trifolium* - 5-5 species each; knotweed/*Persicaria, Polygonum,* blackberry/*Rubus* - 4-4 species each; wormwood/*Artemisia,* cyperus/*Cyperus,* horsetail/*Equisetum,* erigeron/*Erigero,* spurge/*Euphorbia,* bedstraw/*Galium,* soft rush/*Juncus,* mint/*Mentha,* annual bluegrass/*Poa,* sour weed/*Rumex,* groundsel/*Senecio,* starwort/*Stellaria, xanthium/Xanthium* - 3-3 species each and so on.

19. From the species recorded in the research object (landfill) 80 (33.7%) are local, 159 (66.53%) are of alien origin. According the Raunkiaer classification, therophytes prevail represented by 108 species of annual grass species, which is followed by hemicryptophytes with 60 species uniting mainly biennial and perennial grass plants. The dominance of therophytes and hemicryptophytes complies with the specificity of the ruderal flora composition. Phanerophytes are represented with 33 species, cryptophytes – 25 and chamaephytes with 13 species.

20. Among species recorded in the Batumi landfill we came across the species characterized for various habitats – forest, meadow, decorative, humid places, low zone, mountain and high mountainous species as well. Out of 239 species, 91 are representatives of ruderal flora.

21. According to observations, creation of the second cenosis is dominated by the alien species. Those species have reached acclimatization stage, when the seaside Ajara zone may be considered as their second homeland. They blossom, bear-fruit, give self-crops and root sprouts, spread and expel indigenous flora species from the secondary cenosis.

22. Abundance of the East Asian species is caused by several conditions, out of which – the same climate conditions, high humidity, positive temperature indicators during a whole year are worth mentioning.

23. Dominance of hornbeam, abundance of rhododendrons, Persian ivy, greenbrier, alder buckthorn, cherry laurel and local grass species in the cenosis recorded in the Chakvi lowland and appearing of plants characterised for the primary cenosis, gives an opportunity for partial restoration of the initial conditions of phytocenosis.

24. Within the research carried, 3 alien species new to Ajara flora have been recorded – *Verbena brasiliensis Vell.*/South American verbena, *Lobelia urens* **L**./European lobelia, *Passiflora incarnata* L./purple passionflower.

25. The studies and recordings carries in the seaside Ajara, have in total recorded 363 plant species, out of which 137 are local and 226 alien origin. Among the alien species, 91 species are East Asian, 40 – North American, 39 – Mediterranean, 36 – European (including, 32 – Atlantic European), 5 – Australian, 1 – Himalayan, 14 - South American.

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